THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. MAY 28, 1896 CHICAGO, ILL. NUMBER 22.

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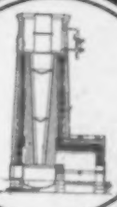

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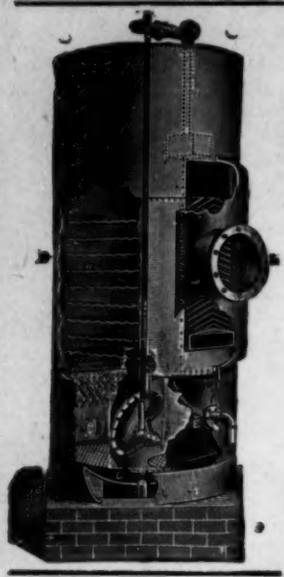

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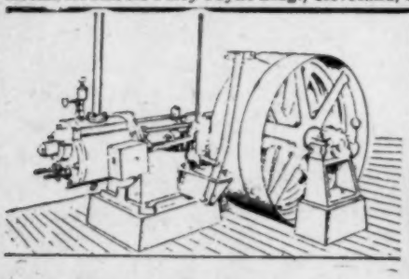

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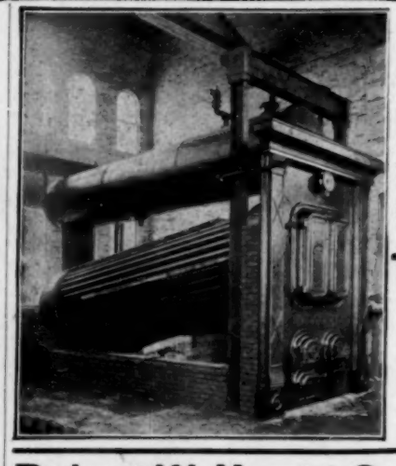

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THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. MAY 28, 1896. CHICAGO, ILL. NUMBER 22.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The belief that business now withheld will be crowded into later months of the year, mitigates present disappointments in the iron trade. Meantime there is a movement in some quarters to stop pig iron production, accumulated stocks being ample to care for any demand likely to come up in the next two or three months. In the Mahoning and Shenango valleys the plans for blowing out or banking in the next 30 days will leave less than half the furnaces active on July 1, if those now out continue so meantime, as seems likely. Eastern Pennsylvania and Virginia are contributing, also, to the curtailment, though in less measure. Beginning with the Lake Superior region, where some slight reductions in working forces have been made in the past week, it is evidently the policy of producers in all lines to adjust operations to the situation as it has been shaped in the three disappointing months just passed. A contagion of postponement seems to have its grip on buyers everywhere; not because of a belief that the unexpected will happen, either as to the next administration or as to the policy this Government has steadily followed, of making its money equal to the best. The real reason many give for this course is that waiting is the order everywhere. In the past week actual business in finished material has not risen above the average of the weeks immediately preceding. Here and there encouraging inquiries are reported, such as followed on the placing of the 75 locomotives for the B. & O. road, but this is exceptional. Bessemer iron has been quiet, after a week marked by two important transactions. The amount of old ore which permits a price below $13 at valley furnace to be named for Bessemer iron, is limited, and it is an exceptional furnace company that does not inventory such ore at the 1896 price. The billet market is drawing near to the time that will test fully the strength of the pool, and the price on outside steel is nearer to that of the pool, with demand very light. Foundries are melting little, if any, more iron than at this time last year. Little iron is carried in their yards, and all are in a hurry for the carload and 50-ton lots that represent current buying. At Detroit the Amalgamated Association and the Merchant Bar Iron Association are in session and conference committees are struggling with the new scale. This time it would seem that the energies of the Amalgamated forces will be concentrated on getting a better rate for the puddler, leaving bar mill and other finishing scales little changed.

THE CLEVELAND DISTRICT.

The larger purchases of ore yet to be made for the Pittsburg district are still deferred. Smaller buyers have done something with each week, but the total of sales does not grow rapidly. On the Gogebic range there has been a slight reduction of working force the past week and the disposition in the ore trade is to keep close step with demand. Non-Bessemer ores have sold on the basis of $2.60 to $2.70 for the most desirable hematites, with Mesabi quotations 20 to 25 cents below this basis. For hard non-Bessemers $3 to $3.15 is asked. Freights have been a trifle weaker since last report. From the head of the lake 95c is the prevailing rate, from Marquette 80c and from Escanaba 55c. Some furnace companies have bought no ore as yet and will wait until all their 1895 stock is used up before coming into the market.

Pig Iron. Seeing that there will be no reduction in the prices of Bessemer ore and coke, the furnace companies are getting a bit of comfort from the lowering of freight rates on ore, pig iron and coke. Railroads whose tonnage has suffered by the encroachments of coke from the Virginias and pig iron from the South, upon the products of districts on which they depend, are reluctantly furnishing relief. Though they have not been ratified by the board of managers of the Joint Traffic Association, it is expected that the reductions in pig iron recommended by the Central Freight Committee will go into effect June 15. A 40-cent decrease on pig iron east and west, from Pittsburg, the two Valleys and Cleveland, is included. On Connellsville coke, the freight will be reduced 25 cents June 1, making the Cleveland rate $1.40 instead of $1.65. In the same connection it is reported that the price of foundry coke is to be lowered from $2.30 to $2.10 at the ovens, but furnace coke will remain at $2. The ore rates from Lake Erie ports to Pittsburg and the valleys is under discussion at a meeting in Philadelphia this week. It is expected that the Pittsburg rate will be lowered from $1.15 to 90 cents or $1, with a corresponding reduction to the valleys. Sales of iron have been almost at a standstill the past week, barring some Bessemer transaction made through Pittsburg offices as noted elsewhere. The price for prompt delivery is from $11.80 to $12.00 in the valley. Foundry irons are unchanged at $12.50 to $12.75 Cleveland, for No. 1, and $12 to $12.25 for No. 2. Carload shipments are the rule. We quote gray forge at $10 75 to $11 Cleveland. Lake Superior charcoal is inactive at $13.50 Cleveland. As indicated elsewhere, five additional valley furnaces will become inactive between now and July 1.

Finished Material. Structural mills have had the bulk of the business in this market the past week. An order for the channels for 2,800 cars of the B. & O. contract, 1,600 tons of bridge material, 600 tons of plates and shapes and 1,000 tons of rails are included in the business closed, which was divided between Cleveland and Pittsburg mills. There is some inquiry on vessel account, and 3,000 tons of material will be needed for one contract on which there is some figuring. Prices are still on the same basis: 1.64c for beams and channels; 1.25c for steel bars, 1.40c for tank steel, 1.34c for angles. Valley rolling mills will probably close down at the end of the scale year and present indications are that a wage deadlock will ensue unless some concession is made by the men or a material advance is seen in values. The scrap market is lifeless. Dealers are holding for figures 50c to $1 above mill offers and an increased percentage of forge iron is being used. We quote No. 1 wrought scrap at $12.75 to $13 old steel rails at $12 to $12.50, old iron rails at $16, wrought turnings at $8 and cast borings at $7.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, May 27.

Business in every class of iron and steel was exceedingly quiet last week. Buyers show no disposition to take hold at the present time, and most dealers do not expect that there will be any increase in sales for the next three or four weeks. As a rule, consumers are not disposed to cavil over prices, but give as a reason for not buying that there is simply so small a demand for their products that they do not desire to increase their stocks of material. It is thought by some that the St. Louis convention will stimulate business, but very few people are able to state just why they base their hopes upon this event. A large Southern manufacturer of pig iron is quoted as saying that he fully believes an era of prosperity will be inaugurated in the early fall and will continue throughout next winter and beyond. He bases his belief on the fact that in England a remarkably low rate of interest—less than ½ of 1 per cent. is now ruling, and a large amount of money in the hands of English capitalists awaits investment. This money, according to the authority quoted, will find its natural outlet in the United States, and will begin to be placed here in loans and investments as soon as the maintenance of a sound money policy is unmistakably assured in party declarations and in the personnel of probable national legislators and executive.

PIG IRON.—Sales of all classes of pig iron last week were very small, and no single orders of any great size. Southern furnaces report a very small inquiry and that they do not expect business will increase for several weeks. Northern furnaces report that there is considerable business hanging fire, inquiries having been received some time ago and the sales not yet closed, but that it is extremely doubtful if any large amount of this business is closed within the next three or four weeks. The local furnaces, however, are quite well sold up, one of them reporting that over five-sixths of its output for the balance of this year has already been disposed of. Malleable foundries have been asking for prices on round lots of iron lately, but so far none of them have placed any considerable orders. Lake Superior charcoal iron is in light demand, and only a few small sales were made. Southern furnaces are maintaining prices very firmly, and are having no difficulty in getting full quotations on such lots as they sell. Northern furnaces have reduced their quotations 25c. a ton, but this reduction does not seem to have caused any influx of orders. Prices are now made as follows:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$11 35@11 60
Local Coke Fdy. No. 1	12 00@12 50	South'n Silveries No. 1	11 85@12 35
Local Coke Fdy. No. 2	11 50@12 00	South'n Silveries No. 2	11 60@11 85
Local Coke Fdy. No. 3	11 00@11 50	Jackson Co. Silveries	14 50@16 00
Local Scotch Fdy. No. 1	12 00@12 50	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	11 50@12 00	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	11 00@11 50	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 1	12 10@12 35	Alabama Car Wheel	16 85@17 35
South'n Coke No. 2	11 60@11 85	Malleable Bessemer	13 00@13 50
South'n Coke No. 3	11 10@11 60	Coke Bessemer	13 00@13 50
Southern No. 1 Soft	11 60@11 85		

BARS.—The bar iron market has been very quiet, and only a few sales of any size have been made. It is thought that some of the railroads are quietly placing orders for cars without taking bids upon them, as in several instances inquiries have been received from car works for car iron when it was not known that these particular works had lately made contracts for cars. This business, however, is not very large. Quotations are made as follows: Common iron, 1.30c to 1.35c; guaranteed, 1.35c to 1.40c; soft steel bars from strictly billet stock, 1.30c to 1.35c.

RAILS AND TRACK SUPPLIES.—The local steel company continues to have a fairly good business in rails, but orders are always for small lots. Quotations are as follows: Rails, $29; splice bars, 1.45c to 1.50c; track bolts with square nuts, 2.05c to 2.15c; hexagon nuts, 2.15c to 2.25c; spikes, 1.75c to 1.80c.

BILLETS AND RODS.—Almost no business is being done in billets, which are still quoted at $21.25, and sales of rods have been so light as to preclude the possibility of making any quotations.

STRUCTURAL MATERIAL.—Mills continue to receive good orders on old contracts but new business is still very light. The largest order placed last week was one for 450 tons of material for a new asylum at Moline, Ill. Another order for 300 tons of bridge material came from Indiana. Aside from these orders business was almost nil. Prices of beams have been advanced $2 a ton and quotations are now as follows: Beams and channels, 1.75c to 1.80c; angles, 1.45c to 1.50c; plates, 1.50c to 1.55c; tees, 1.65c to 1.70c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—No especially large business was done in this market last week, the only orders closed ranging from 50 to 100 tons. Quotations are now made as follows: Tank steel, 1.50c to 1.55c; flange steel, 1.70c to 1.75c; fire-box steel 2.35c to 5c; boiler tubes, 70 to 75 per cent discount.

SHEETS.—The demand for immediate delivery is very light, but there appears to be some inquiry for sheets for delivery extending considerably into the future. Quotations are unchanged at 2.30c to 2.35c for No. 27 black sheets, and 75 and 10 and 5 per cent discount for galvanized.

MERCHANT STEEL.—There is a rather better inquiry for small lots from store but not such as to indicate that sales in the immediate future will be increased materially. Quotations are made as follows: Open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.60c to 1.65c; smooth finished tire 1.55c to 1.65c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

OLD RAILS AND WHEELS.—There has been very little business in either old rails or wheels in the last week and it is not likely that the immediate future will show any great increase in the demand. Buyers and sellers of material are quite wide apart in their views as to prices, but quotations are nominally as follows: Old wheels, $13.00 to $13.50; old iron rails, $14.50 to $15; old steel rails, $10.00 to $11.00.

SCRAP.—Transactions were very light, and as the inquiry is small dealers do not expect a very much better business in the near future. The following are buying quotations furnished by dealers: Railroad forge, $11.50 to $12; dealers' forge, $10 to $10.50; No. 1 mill, $8; heavy cast, gross ton, $9 to $9.50; malleable cast, $9.50 to $10; axles, $15; cast borings, $4.25; wrought turnings, $5.25; axle turnings, $6.50; mixed steel, $7.75; stove plates, $7; heavy melting steel, $9 to $9.50.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, May 27.

The large transactions in Bessemer iron, reported last week, have not changed the situation, and it is evident that the furnace interest does not regard the $12.50 valley sales of Bessemer iron for the second half of the year as establishing a basis. On an additional sale in the past week to a Northern Ohio steel works $12.45 valley was the price, deliveries to Jan. 1. Demand is halting in every branch of the trade, and buying for immediate re-

quirements is still the order. Inquiry has also dropped off in some lines. Buyers have little trouble in making purchases below asking prices.

PIG IRON.—A sale of 6,000 tons of Bessemer is reported, on the basis of $12.45 valley furnace, for delivery in the second half of the year. A few prompt transactions are reported—two of 1,000 tons each at $12.50 and $12.65, Pittsburg, respectively, and one of 1,000 tons at $12.75, June delivery. To a valley steel company an additional 4,000 tons has been sold since last report. Foundry iron is perhaps a trifle more active, with No. 1 at $12.50 to $12.75, and No. 2 at $11.75 to $12.25. Gray forge is quoted $10.75 to $11. A sale of 500 tons at $10.90, one of 300 tons at $10.85, and one of 1,000 tons at $10.75 are reported.

BILLETS AND RODS.—Two sales of billets, 500 tons each, are reported at the pool price, though deliveries to middlemen have not yet been completed by steel works. Some mills that contracted for billets at a low price early in the year have not been able to use the steel as fast as delivered and have been sellers of the surplus. As the supply of outside billets decreases prices are approaching the pool rate, the quotation now being $19.85@$20. Very little is done, however, at any price. Rods are not in demand, but are nominally $26. Sheet and tin plate melts are not in the market for slabs or bars. On sheet and tin plate bars the pool price is held, but most mills have material still coming to them on old contracts and will run on these through June.

STRUCTURAL MATERIAL.—The advance of $2 a ton on beams and channels made last week was not unexpected. It has had a tendency to stimulate inquiry in some directions. No contracts of large size have been taken lately, but the volume of small orders is good and local mills are running on quite regular schedules. We quote beams and channels at 1.55c and angles 1.25c to 1.30c.

PLATES.—Some local mills have orders that will occupy them fully to the end of June. The B. & O. order for 75 locomotives has stimulated inquiry for appropriate grades of plates, and this market is getting a considerable portion of the business. We quote 1.30c for tank steel; 1.35c to 1.40c for shell, and 1.45c to 1.50c for flange.

SHEETS.—There is only a fair demand and prices are unsatisfactory. The market for light sheets is weakened somewhat by tin plate mills rolling these gauges to keep their mills occupied. Their wage scale gives them an advantage in cost over the sheet mills. Sales are mostly limited to June delivery. We quote No. 26 at 2.05c; No. 27 at 2.10c to 2.15c, and No. 28 at 2.20c to 2.25c. The higher cost for raw material and the probability of a demand for higher wages, or at least the same, make the outlook unpromising.

BARS.—We quote common iron at 1.20c and steel at 1.15c and 1.20c with demand unchanged.

PIPES AND TUBES.—Beyond inquiries for 32 miles of gas pipe of various sizes, to be laid in the Indiana field, there is no special business up in this line. Manufacturers quote these discounts: Butt weld black, 57, four 10s and 5 per cent.; lap weld, 67, four 10s; butt weld galvanized, 52, four 10s and 5 per cent.; lap weld galvanized, 55, four 10s.

OLD MATERIAL.—The market is very quiet and mills are keeping close to their requirements. We quote $12.50 to $13 for steel rails; $12.50 for No 1 wrought scrap; $11 to $11.25 for cast scrap; $16 to $16.50 for old iron rails.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Cincinnati. No notable transactions in iron have taken place and but few are in view. Cutting of prices would not tend to enlarge business much, and sellers are refraining from trying to put quotations low enough to induce speculation. If the efforts being made to restrict production are successful, there is a fair chance that demoralization will be prevented. It is inevitable that a revival in demand will come, but even professional prophets are puzzled and do not fix the time. Prices of all kinds of pig iron remain unchanged.

Buffalo. The market has shown a trifle more life; but the orders are of the carload and 100-ton variety. However, as they are for immediate shipment, and the consumer in a hurry for the iron, it indicates stocks of foundry iron on hand in consumers' yards are light. If anything, the lines seem more closely drawn between the consumer and producer, in that many furnaces are nearing the end of their stock of ore purchased last year and must figure their cost on a higher basis.

Annual Iron and Steel Report.

The annual statistical report of the American Iron and Steel Association for 1895 has just been issued. It contains a general review of the condition of the iron and steel industries of the United States in 1895 and in the first four months of 1896, including monthly prices of iron and steel in 1895 and 1896; the prices of iron and steel for preceding years; complete statistics of the production of all the principal iron and steel products of the United States in 1895 and immediately preceding years and of the production and prices of tin plates since the passage of the McKinley tariff; statistics of the imports of tin plates for a long series of years; statistics of the production and imports of iron ore in the United States in 1895 and preceding years; statistics of the production, imports and exports of coal and coke; statistics of the mileage of new railroads and of the construction of iron and steel ships in the United States; statistics of imports and exports of iron and steel and manufactures of iron and steel; detailed statistics of immigration; a record of the deaths of iron and steel manufacturers in 1895 and 1896; statistics of the iron and steel industries of Canada; and latest iron and steel statistics of European countries There is also a careful review of the development of the iron and steel industries of the United States from colonial times to the close of 1895. The report contains 78 pages and is well printed on good paper. It is marked by the same completeness and accuracy that characterize all the statistical work of Mr. Swank's office, and as heretofore is the promptest official publication in all the literature of iron and steel production. The price is $3.

Personal.

J. E. Baker, representing an English firm of machinery manufacturers, has been inspecting various mills in Pittsburg during the past week.

Wm. P. Palmer, formerly assistant to the president of the Carnegie Steel Co., Ltd., has been tendered a similar position with the Illinois Steel Co., and it is understood will accept.

John F. Taylor, treasurer of the Brown-Bonnell Iron Co., Youngstown, O., has gone to Europe for a health trip.

Franklin Hilton, formerly manager of Bolckow, Vaughan & Co.'s Works at Eston, and now connected with the Ebbw-Vale Steel Works, in South Wales, and Mr. Summers, of Manchester, Eng., sailed from New York last Saturday after a trip of several weeks through the United States.

Jno. L. Garner, of the F. Jarvis Adams Co., Pittsburg, is home from a two months' sojourn on the Pacific Coast.

W. R. Stirling has resigned his position of first vice president of the Illinois Steel Co., and will devote all his time to the business of the Universal Construction Co., of Chicago, of which he is president. C. H. Foote, manager of the South works of the Illinois Steel Co., has been elected first vice president.

THE IRON TRADE REVIEW

DEVOTED TO IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES.

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MAY 28, 1896.

THE TIN PLATE DUTY AND DRAWBACK.

One of the first changes in the tariff that is likely to be made under a protection regime is the abolition of the drawback system. Answering neither the revenue nor the protective requisites of American tariff legislation, it has been incorporated in the acts of recent years in answer to the demand for some provision that would extend the market for American products. The theoretical argument has been that the primary industry—that with which the imports would naturally compete, on which the 99 per cent. duty is remitted—does not lose anything, because export trade would be impossible to it, with its high labor cost. The secondary industry—the one using the protected product—is therefore given a chance to do what it can with duty-free materials. In the case of tin plate, it is not necessary to conclude that the foreign trade of the Standard Oil Co. would be cut off if the drawback were abolished. Concessions both on the price of American tin plate and on the margin of profit to the Standard Oil Co. might be necessary to hold the markets now occupied; but in return an important tonnage would be added to the business of American tin plate mills, steel works, blast furnaces, railroads, iron mines, coal mines, coking plants, and so on through the list of industries that would be directly benefited by an increase in the consumption of home-made tin plate.

Tin and Terne notes that "in the fiscal year ending June 30, 1894, $3,523,094.35 drawback was paid to importers of tin plate on account of its re-export. The total duty collected on these plates, at 2.2 cents per pound, amounted to $3,558,683.94, representing 161,758,361 pounds. Almost the sole beneficiary of this system is the Standard Oil Co." Now that the tin plate manufacturers of the United States have made such a magnificent record for their industry, not only maintaining it, but building it up to larger and larger proportions, against foes without and no less active foes at home, it is time that legislation gave some relief from the strain of the past 18 months—first, by the abolition of the drawback, and second by the restoration of, say, 50 per cent. of the 1c. cut made in the duty by the Wilson bill, putting it at 1.7c.

A YEAR OF FOUNDRY PROGRESS.

A significant feature of the reports submitted at the annual meeting of the Western Foundrymen's Association at Chicago, is the statement that in the past year the membership has increased from 64 to 114. No one who has watched this association will be at a loss to understand this very satisfactory growth. The officers, and particularly the secretary, on whom the success of such an association largely depends, and the editing committee, have all done excellent work, bending their energies to the one end, that every member might have ample return for his expenditure of time and money. The papers and discussions of the year have covered a wide range of topics in foundry practice, and a reference to the secretary's report on this part of the work will show that everyday questions, on which foundrymen want all the light the experience of others will afford, have been selected, to the exclusion of the theoretical and that which interests only the few, following special lines of inquiry.

Contrary to what has been noticed in some associations, the discussions at the meetings of the Western foundrymen have not lacked for participants. Superintendents and foremen and such proprietors as have an active supervision of their foundries and are thoroughly informed as to the problems of the molding floor and questions of foundry management, have been on hand and have spoken out of their experience. This fact, we believe, is the key to the marked success of this Western organization, which has done much in the past few years to give the foundry industry a standing of its own, lifting it out of the place it has so long occupied, of a mere adjunct to the machine shop. Much of the credit for this result is due to the intelligent and well-directed effort of the secretary and the editing committee of the Western association. Besides knowing in what direction foundry managers most needed assistance, they have been fortunate in choosing the right men to present the selected topics.

It is not the intention, as we understand it, to have the newly organized American Foundrymen's Association interfere in the least with the good work done by the Eastern and Western associations. Unification of the foundry interest of the country seems to be the main object of the new organization. Beyond that we do not find in its constitution any statement of purpose that differs from those of the existing associations. Some ulterior plan may have been in the minds of those who brought about the Philadelphia convention—some undefined idea of a compact organization to fix prices and correct demoralizing competition—but it seems to have been abandoned as impractical, in view of the large number of American foundries and the great diversity of their product.

The monthly meetings of the sectional associations will continue to be the prime educational agencies in the foundry trade, the National association with its annual convention crystallizing the results of the year's papers and discussions. In time, the National association may carve out for itself a distinctive field, uncovered by the sectional organizations, supplementing their work of making a literature of the foundry, by definite results in the direction of improved prices and more satisfactory handling of the labor question. Of the possibilities here a year's record will give better opportunity for judging.

THE negotiations recently in progress, to put an end to the sharp competition between English and American manufacturers of cotton ties, promise to be successful. The imports of cotton ties to the United States last year

were only about 3,500 tons, though the foreign manufacturers, in view of the very unjust discrimination against this home industry, by the Wilson bill, had reason to believe they would capture everything on this side of the water. However, the improved methods developed under a protective duty put American mills in position to compete for some of the Southern trade, though at figures that gave no living profit. Further, as an earnest of what might be done in the field British manufacturers have considered all their own, one American mill, by the help of a specially advantageous freight, sent a cargo of ties to India a short time ago. Under these conditions there was little chance for profit to either English or American manufacturers and the arrangement recently made between them restricting to 5,000 tons the shipments of cotton ties from England to the United States, and establishing a price that will allow of a profit, is a natural result. There will be little regret that the blow aimed at the American cotton tie industry has fallen short of its intended execution.

THE developments at the Pittsburg meeting of the wire nail manufacturers, who adjourned Wednesday night, are not favorable to the long continuance of the pool's agreement. The trade has had plenty of time to prepare for its dissolution, as each successive advance in the past eight months has given fresh ground for the fear that top-heaviness would yield its legitimate result. But the coming down has its dangers. If the pool mills decide to give the outside concerns a season of unchecked competition, there is no predicting the end. Should the outside mills give a negative answer to the pending overtures, and the New York meeting of next week bring an end to the agreement, the proposition for a rod pool as a means of steadying the market will be pressed anew for settlement.

THE meeting between the labor bureau of the Merchant Bar Iron Association and the conference committee of the Amalgamated Association ended at Detroit yesterday with no prospect of agreement and no appointment for a resumption of the conference. The manufacturers, in view of the profitless business of the past six months, through the intermittent operation of their mills, are not willing to commit themselves for a year to an advance in the puddling scale, and it is altogether likely that the end of June will see a very general suspension of operations. With some mills this may be prolonged through the summer.

WAGE CONFERENCES BEGIN.

The National Convention of the Amalgamated Association of Iron and Steel Workers has continued its sessions at Detroit the past week. On Tuesday, May 26, the Merchant Bar Iron Association met by appointment in Detroit, and a preliminary meeting between the wage committee of the manufacturers and the conference committee appointed by the workers was held May 27. As was the case last year in Cleveland, the Pittsburg mills were not represented in this conference. The most conspicuous change in the scale, so far as announced, is an advance in the puddling rate, on a 1 1-10 cent card, from $4.00 to $4.50. An advance of 25 cents for each 1-10 cent advance in iron would mean $4.75 on the present market of 1.20c; for 1.30c bar iron $5; for 1.40c bar iron, $5.25, and $5.50 for a 1.50c market. This, it is understood, the manufacturers will oppose. They contend that neither present conditions nor the outlook warrant an advance of 12½ per cent. in the puddling rate. They will oppose, also, the abolition of the 60-day adjustment of the scale, which has been in vogue the past year. The present price of bar iron, 1.20c, entitles the men to $4.25 for puddling, and the manufacturers will make a stand for a continuance of the present rate. There is practically no change in the foot notes of the boiling scale as adopted by the Amalgamated convention.

It is understood that the men have left the sheet mill scale substantially unchanged, concentrating their efforts in behalf of the puddler. It is stated, though unauthoritatively, that on finishing mills no advance is asked until the market price reaches 1.50c. The past year each 1-10 advance in bar iron carried a 2 per cent. advance in wages. The sheet mill scale, as decided on, is as follows: "It is agreed that when the actual average selling price of Nos. 26, 27 and 28 gauge plain sheet steel, f. o. b. mill, is 2½c per lb., the wages for rolling on a sheet and jobbing mill shall be as follows, with 2 per cent. additional for each one-tenth advance from above said 2½ cents selling price and 2 per cent. decline for each deduction of one-tenth to said 2½ cents selling price:

"Price for rolling iron per ton, 2,240 lbs.: 8 and heavier, $3.24; 9 to 11, $3.60; 12 to 14, $4.32; 15 to 17, $5; 18 to 21, $6.08; 22 to 24, $7.20; 25 and 26, $8.28; 27, $9; 28, $9.59, 29, $10.03; 30, $10.80; 31, $14; 32, $17.

"Price for rolling steel per ton, 2,240 lbs.: 22 to 24, $7.92; 25 and 26, $9.11; 27, $9.90; 28, $10.55; 29, $11.03; 30, $11.88; 31, $15.40; 32, $18.70; 8 and heavier, $2.70; 9 and 10, $3.15; 11, $3.00."

The meeting between the conference committee of the workers and the tin plate manufacturers will be held in Pittsburg early in June. The Tinned Plate Manufacturer's Association will hold its annual meeting at Pittsburg Tuesday, June 2. While no changes were made in the base of the tin plate scale at Detroit it is understood that a number of foot-note provisions have been altered, and that the manufacturers, in view of the high price of steel that hangs over their heads, and the unabated sharpness of competition from imported tin plate, will ask that some concession be made. The fact that a half dozen tin plate works are run non-union is another element that figures prominently in the presentation that will be made of the manufacturers' case.

STATUS OF VALLEY FURNACES.

The movement to curtail pig iron production in the Mahoning and Shenango valleys is going on without any concerted arrangement. Each furnace company decides the question in the light of its own condition and the state of the market. Stocks have been accumulating, with demand of small proportions, and no immediate prospect of a revival. Opportunely, the flatness of the market and the plans of some furnaces for extensive repairs coincide; in other cases furnaces will be banked because operating companies do not desire to pile further iron on an unprofitable market. Inquiries by *The Iron Trade Review* show that the following valley furnaces are now in operation: Mahoning Valley—Grace (Brier Hill), Phœnix, Cherry Valley, Haselton, Hubbard No 1, Mary, Mattie, Seneca, Thomas, Tod; Shenango Valley—Atlantic, Mabel, Rosena, Douglas, Neshannock, Raney & Berger, Sharon Iron Co., Alice. Furnaces now out of blast are: Hubbard No. 2, Hannah and Anna, in the Mahoning Valley, and Claire, Sharon, Sharpsville, Spearman (put out May 27th), Stewart, Ella and Fannie in the Shenango Valley.

Of the furnaces now out, Anna, undergoing repairs, will go in about July 1, and Stewart, banked the past week for repairs, will resume next week. Of the furnaces now running, Haselton will blow out early in June for extensive repairs, Mattie will go out in the next 30 days, and Mary will stop in June, all for relining and other improvements. Hubbard No. 1 will bank pending a turn in the market. In the Shenango Valley, Douglas will probably quit early in June, if there is no improvement in the market; Raney & Berger will exhaust its 1895 ores and may then shut down, perhaps by August 1 if there is no change for the better. Haselton furnace has been in blast 4½ years on one lining, bosh and hearth. It will be out 60 to 90 days, relining, making necessary repairs, putting in new blowing engines, new pumping station, etc. Mary Furnace at Lowellville will put in a new lining, increasing the size of the furnace. There has already been added a large blowing engine, made by Wm. Tod & Co. and an additional battery of boilers, together with minor changes which will materially increase the output.

STRUCTURAL STEEL FLY-WHEELS.*

BY THOS. E. MURRAY, ALBANY, N. Y.

With the increasing use of large and fast-running engines in the generation of electric power, the problem of providing fly-wheels which shall not be liable to bursting, is one of great and growing importance to the mechanical engineer. This is especially so because large power stations are usually and necessarily located in the central and crowded sections of cities, where any accident is liable to cause much loss of life and the destruction of much valuable property. That large iron castings are unreliable, when subjected to sudden and severe strains, is recognized by all. It is evident that cast iron fly-wheels have reached the limit of development, and it is doubtful if much further improvement is to be expected in them. The frequent accidents to large wheels of this type show that there must be some radical change in construction in order to make wheels which shall be free from danger of bursting by centrifugal force. With the cheaper production of steel, the latter metal, in nearly every branch of mechanical industry, has taken the place of cast iron; and the object of this paper is to describe a novel application of steel plates as a substitute for cast iron in fly-wheels.

The engine for which this new wheel was designed and made was one of a pair in the power house of the Albany Railway, at Albany, N. Y. The former cast iron wheel, which it replaced and which was 20 feet in diameter by 50 inches face, and weighing 50,000 pounds, burst, causing considerable damage. It was connected to a 20-inch by 36-inch by 48-inch tandem compound engine, and was belted to a 48-inch pulley located on a 500 K. W. Generator.

Running under normal conditions this engine made 72 revolutions per minute. At the time of the accident, the speed of the engine (according to statements given at the time, and from computations made from the distances that portions of the wheel were thrown) was far beyond the conditions of every day practice.

The author does not attempt to state here the cause of the accident, or the acceleration in speed, but his faith in cast iron fly wheels was considerably shaken, and to replace the broken wheel he naturally looked for something better and of different material, which would stand the very high rate of speed and have a greater factor of safety, and, at the same time, locate the weight in the wheel where the best results would be accomplished.

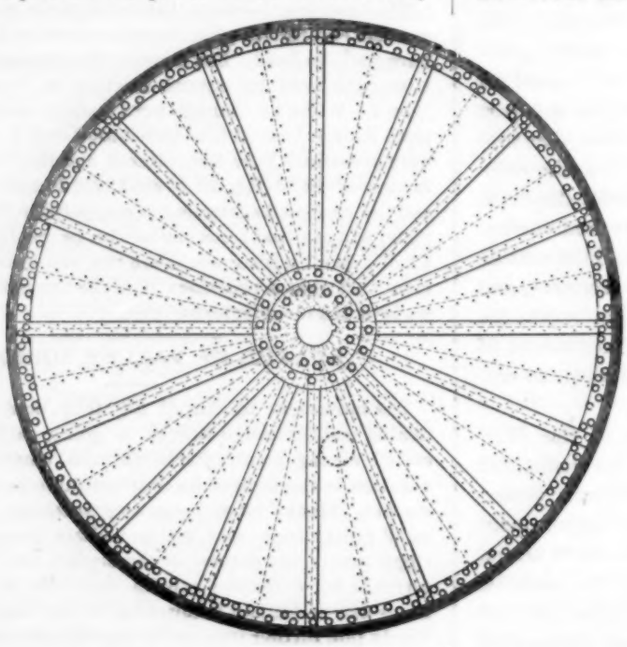
As some balance wheels had been constructed of structural steel with good results, the writer looked for a belted wheel of the same material, but was unable to locate any which had been built, and accordingly designed a wheel as per the accompanying drawing, and an order was placed for two wheels with Harry E. Campbell of the Albany Construction Works.

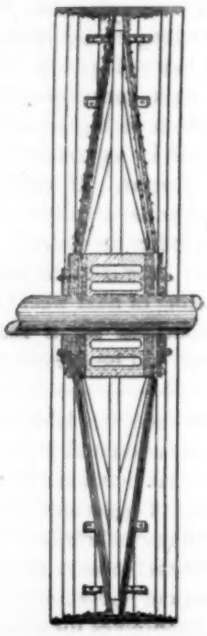
It may be well to say here that the wheel was not designed to run at 72 revolutions per minute; or at any stated factor of safety, but the construction was of the strongest possible at a moderate cost. I am well aware that certain parts of the wheel are much stronger than others, as for instance, the hub and disks which take the place of the arms or spokes.

DESCRIPTION OF WHEEL.

The steel was of a grade known as "shell steel," open-hearth process, and of 60,000 pounds tensile strength, and great care was used to have grain, in the direction in which the plates were rolled, placed in position so as to give the greatest strength. All rivets used were burden's best, and were of two sizes, namely, 1¼ inches and ¾-inch in diameter.

Hub.—The hub is described as follows: Six ¾-inch disks were sheared 36 inches in diameter, and 14 48 inches in diameter, and these plates together with the cast iron separator or spider 23 inches long by 48 inches in diameter composed the hub, and were assembled as follows: Two sets, composed of three 36-inch and three 48 inch disks each, were drilled for 32 counter-sunk rivets, and after being securely clamped to tight joints were riveted together, making two hub sections for outer part of wheel hub, each 4½ inches thick, and these were bored to a "driving fit" to shaft; two sets of four discs each were secured together and bored in same manner for inside sections of hub, giving a steel bearing on shaft of 15 inches. The casting or spider, weighing 2,700 pounds, was bored to a close fit and placed on the shaft This casting was faced on ends and cored for 32 1⅛-inch hub bolts and provision made for keys. The four steel hub sections were next clamped together and bored for the 32 steel bolts. The two sections, 48 inches by three inches, were driven on the shaft, one against each end of spider, and one of the 36-inch by 48-inch by 4½-inch started on each end of shaft and driven past bearings after which the shaft was set set in position in bearing. Each part of hub was faced to right angles with bore.





Discs.—Two dished webs were formed 19 feet 6¾-inches in diameter, each composed of two layers of ¼-inch plate, and each layer having 16 sections, making 64 plates in all. These plates were drilled so as to have all joints broken. Said rivet holes were three inches on centers, staggered, and four lines of holes running lengthways of plate. The small ends of plates were heated and bent on a form to right angle to shaft, and each drilled for two 1⅛ hub bolts. The rim ends of plates were drilled for two lines of rivets and in such a manner as to properly secure segments of six-inch by six-inch by ½-inch angle irons. These plates were next connected between inside and outside hub steel plates, sections forming two complete dished discs which were two inches apart at rim and 29 inches apart at hub. Thirty-two five-inch by ¾-inch steel bars were fitted one over each outside joint of disc

* Read at the St. Louis meeting of the American Society of Mechanical Engineers, May 19-21, 1896.

plates with hub end bent, and rim ends formed two right angles with center of wheel or parallel with shaft. This end was bent to secure rim in connection with angles and were each drilled for two 1¼-inch rivets. Great care was used in making these bends and sharp angles were avoided. All bars were drilled from a template. After the bars and plates were assembled in position, with temporary bolts, the hub was bolted together with bolts passing entirely through hub and discs and drawn close and firmly together, each bolt passing through two bars, four plates and all parts of hub. Between the outer edges of discs a cast iron filler ring was placed and all bolted temporaily together. As all parts were drilled to templates, the work proved true and in line. The riveting was done from the outside with one man inside holding on and taking the hot rivets through a man-hole left for that purpose.

Rim.—The manner of constructing the rim was as follows: Eight 32-inch by ½-inch plates were rolled to form a circle and riveted to, and with joints over the five-inch by ¾-inch bars. Over these plates another layer of 40-inch by ⅝-inch plates, in 16 parts, was placed with joints broken over the first layer. The six-inch by six-inch by ½-inch angle iron were next formed and securely riveted and bolted to discs, and also through both rim plates, with countersunk rivets. The ⅝-inch by ½-inch plates were also riveted together, rivets four-inch centers. Another layer of ⅝-inch plate, 50 inches wide, was next riveted on. This was also cold rolled and the last or face sheet, 50-inch by ⅞-inch, was rolled hot and riveted on. The countersink of last sheet was almost its full thickness; 64 1¼-inch rivets were driven through the five inch by ¾-inch bars, and all rim plates connecting all plates and discs. The wheel was then keyed to shaft with two cast steel keys, one driven from each side of hub, and without turning or facing the wheel in any way, the belt was put on and the wheel put to work. The belt remained in center of wheel, and has been running two months. There are three points in the diameter of wheel which buckles in plate, due to heating, raised $\frac{3}{16}$-inch out of true, but the balance of wheel is practically true and in line with shaft. The wheel will be turned later. The weight of wheel is 57,930 pounds, distributed as follows:

Rim	32,010 pounds.
Discs	16,400 "
Hub	9,530 "

In calculating the strength of this wheel we need not begin at the hub and figure out every part as in a cast iron arm-wheel. It is enough to know its strength at the weakest point, which is undoubtedly the outer layer of rim plates, as those plates must leave the wheel before any other part could give way.

Each of these plates weighs 590 pounds, and the direct centrifugal force on each plate, tending to hurl it off the wheel, is, according to Haswell's formula:

$$F = W\frac{n^2 d}{5217} = \frac{590 \times 72^2 \times 20}{5217} = 11{,}725 \text{ pounds nearly.}$$

But these plates are held in position by rivets having a total area of 20.75 square inches, which at a strain of 15,000 pounds per square inch would carry 311,250 pounds.

Then the factor of safety $\frac{311250}{11725} = 26$ nearly.

I regard the device of making the discs or webs dished on the same principle as a bicycle wheel, as the most important feature of this wheel, and I believe it could be applied with success to broad faced wheels for mill work by using double pairs of discs, and also to balance wheels, such as are used with direct connected engine for the generation of electric light or power.

THE Struthers Furnace Co., of Cleveland, has been incorporated with authorized capital stock of $200,000. The company will operate the Anna furnace at Struthers, O., which recently passed to Runyon, Stubbs & Co., from the Brown-Bonnell Iron Co. W. C. Runyon is president; J. B. Stubbs vice president and treasurer; A. Grossman, secretary, and S. A. Richards, general superintendent.

THE Edgar Thomson Steel Works have shut down for one week. Changes in the rolls will be made, permitting of rapid transfers from rails to billets. A shipment of 10,000 tons of rails is going forward to Japan via Baltimore, and a 5,000-ton order from Brazil has been filled recently.

HOLLOW STEEL FORGINGS.*

BY H. F. J. PORTER, CHICAGO.

By this name I do not refer to steel forgings that have been forged solid under a hammer or press and subsequently bored, but to forgings which have been "forged hollow."

In order that I may not be misunderstood, I will briefly describe the process of making the type of forging referred to. Supposing that we have designed a hollow shaft or roll or cylinder of outside diameter D, inside diameter D^1, length L, and solid volume $\frac{1}{4}\pi D^2 L$, an ingot must be cast to forge it from having a diameter 2 D, volume $\frac{1}{8}\pi D^2 L$ and length L^1. From the upper part of this ingot 25 per cent. is cut off and rejected, and a hole of diameter D^1 is bored through the longitudinal axis of the remainder. This is then reheated, a mandrel of diameter D^1 is run through the axial hole, and then the mass is forged down under a hydraulic press from 2 D and length L^1 to D and L, the inside diameter D^1 remaining the same.

The reasons for adopting this method of producing hollow forgings are many and various and the result of long experimenting. In the first place, as the walls of hollow forgings are comparatively thin, the metal must be thoroughly worked, homogeneous throughout, and absolutely without flaw or defect of any kind. For this purpose, therefore, only open-hearth steel is used, and that of a grade that will best insure satisfactory working. Its carbon may vary according to the purposes to which the forging will finally be applied, but its phosphorus and sulphur should not exceed .04 per cent. In order that the metal should be sufficiently worked to give it strength and toughness, the best practice requires that the ingot should be at least twice the diameter of the finished forging. A 24-inch or 36-inch shaft or roll, for instance, would be worked down from 48-inch and 72-inch ingots respectively. Ingots of these sizes are liable to "surface defects," "blow holes," "piping," and "segregation." To aid in avoiding the two latter, ingots are made from 25 to 30 per cent. longer than necessary, as these defects occur in the upper and central portion, that being the locality of last cooling. This part is subsequently cut off and returned to scrap. Of all the various methods that have been devised to secure solid and homogeneous ingots, without doubt the most efficient and most to be depended upon is the "Whitworth process of fluid compression." This consists in subjecting the metal in the mold, while fluid, to hydraulic pressure up to 7,000 tons if necessary. This pressure is continued until the metal is solid throughout, great care being taken to cool the ingot slowly and equally on all sides. After it has cooled and the upper part has been cut off, a hole nearly the size required in the finished forging is bored through it. This boring out of the center takes away that portion of the ingot where impurities may have concentrated and where there may have been a tendency toward "piping."

We have now a piece of steel which is as nearly perfect as can be produced, and it is ready for the forging process. First it must be reheated, and as much care has to be taken in this process as was taken in its cooling. The heat must penetrate it slowly and uniformly. Its shape, however, is in its favor. The hole in its center removes the danger of cracks starting in that part, owing to the expansion of the exterior from more rapid heating. After being reheated, a mandrel of the proper size to fit loosely into the hole is inserted, and the piece is taken to the press, where it is drawn out over the mandrel to the required dimensions.

One of the principal requisites in forging is the proper selection of forging tools, suitable in design and power for the work in hand. The pressure applied in shaping a body of steel should be sufficient in amount and of such character as to penetrate to the center and cause flowing throughout the mass. As this flowing of the metal requires a certain amount of time, the requisite pressure should be maintained throughout a corresponding period. The hydraulic press instead of the hammer is therefore used to work it into shape. Under its action the forging is slowly operated upon and the pressure distributes itself evenly throughout the mass, whereas under the high velocity of impact of the hammer the metal

* Extracts from a paper read at the St. Louis meeting of the American Society of Mechanical Engineers, May 19-22.

does not have time to flow, thus causing internal strains and possibly cracks. These latter would be fatal defects, for, as steel has not the property of welding, they cannot be remedied. Besides the undesirability of using the hammer on steel for the above reasons, it is a very difficult matter to make a forging of this charater except by the use of the hydraulic press. A slow and even pressure is absolutely necessary to draw out the thin cylindrical walls equally and make a shaft that is straight and symmetrical throughout. The varying impact of the hammer works the metal so unevenly that the mandrel is apt to stick fast in the forging. For this type of steel forging, therefore, it is practically imperative that the press be used, and thus the metal is unavoidably subjected to the best method of treatment.

During this process of working down the metal from $2D$ to D and extending it from L^1 to L, it is probable that the entire piece, or at least the end of it, which is being worked upon, will have to be reheated from time to time. Operating on metal which has become too cold to flow would injure it by disturbing the continuity of its structure, and thus establishing lines and planes of weakness.

After the process of shaping to the proposed design has been accomplished, the piece must be subjected to a final treatment of "annealing." After all the manipulation to which it has been subjected, together with its frequent partial heatings and irregular coolings, it undoubtedly has strains set up in it. It is to relieve these strains that it must be annealed. This treatment consists in heating the forging slowly in a furnace and then allowing the latter to cool down slowly with the forging in it. *All* forgings, whether hollow or not, should be annealed, otherwise there is a ce tainty of the forging strains developing into weakness after they have been in service, causing them to get out of true, with a possibility of their breaking, particularly if subjected to alternating strains as in heavily weighted shafts or connecting rods, and especially piston rods, which are subjected to changing temperature. Annealing not only relieves these strains, but gives a finer grain and increases toughness.

Assuming that steel less than 10 inches in thickness may be submitted to a fibre strain of 12,000 pounds per square inch, and when 10 inches thick and thicker it must not be submitted to a greater strain than 10,000 pounds per square inch, we may so reduce the thickness of metal operated upon in shafts of large diameterr than 10 inches, by hollow-forging them, that the walls will be less than 10 inches in thickness.

Under these circumstances, hollow forged shafts are shown to be as strong, or stronger than solid shafts of the same diameter. Taking for example a shaft 32 inches outside diameter, 16 inches inside diameter, we find that when compared with a solid shaft of the same outside diameter it has lost 25 per cent in weight and gained 12 per cent in strength.

With the substitution in the trade of steel for wrought iron in engine and miscellaneous forgings, the tendency has naturally been to use a mild or soft steel approaching iron as regards physical qualities, and in the ease with which it can be machined. Wrought iron has a low elastic limit averaging about 20,000 pounds per square inch in large sections, where proper care is taken in its production.

Although mild steel, when of good quality, is superior to wrought iron in strength, toughness, homogeneity, and freedom from danger of imperfect welds and porous spots enclosing slag and scale, still it does not possess the very desirable quality of high elastic strength combined with ductility or toughness in as great a degree as can be obtained without danger in a harder steel, when proper precautions are taken in its manufacture. In other words, in the use of ordinary mild steel, only a partial advantage is taken of the most desirable qualities of steel which are easily within reach. In some instances where the amount of machine work in finishing is very great and there is ample margin of safety in the design, as, for instance, is often the case with connecting rods, the use of mild steel may be advisable. Such steel contains about .20 to .25 of one per cent carbon, and can be guaranteed to show, in specimens four diameters in length cut from a full-sized prolongation of forgings, or from representative pieces, a tensile strength of not less than 57,000 pounds per square inch, and an elastic limit not less than 27,000 pounds per square inch, with an average elongation of 25 per cent. For the general run of engine forgings, however, a harder steel should be used in which a tensile strength of about 75,000 pounds and an elastic limit of 35,000 pounds per square inch can be obtained, together with an average elongation of 20 per cent in four diameters.

When proper precautions are employed, forgings can be made with perfect safety of a still higher grade of steel, and this is especially recommended for crank and cross-head pins and for all parts subject to severe alternating strains and wearing action. In this grade of steel a tensile strength of about 85,000 pounds and an elastic limit of about 40,000 pounds per square inch can be obtained, with an elorgation of 15 per cent in four diameters. If steel forgings are tempered they will possess still higher qualities than those above mentioned, and can be furnished with a tensile strength of 85,000 to 90,000 pounds and an elastic limit of 45,000 to 55,000 pounds per square inch, and an elongation of 15 to 20 per cent in four diameters.

Fluid compressed steel of .40 to .45 of one per cent carbon and more especially nickel steel, oil-tempered, is markedly adapted for piston rods of rock drills, mining machines and hydraulic presses, and for drop-hammer rods, stamp stems, cam shafts and similar pieces that are subjected to stress alternating between tension and compression, or of either kind, frequently repeated. By substituting steel of this grade, which would have an elastic limit of about 60,000 pounds per square inch, for wrought iron or mild steel, which is generally used for the purpose, and by so proportioning the cross section that the metal is not strained beyond one-half the elastic limit, so-called "crystallization" from shock or vibration does not occur and their life is prolonged indefinitely.

The ability to produce forgings of this hollow variety has led to their adoption in many places where castings, both of iron and steel, have previously been used. This substitution has resulted in considerably lightening the dimensions of such pieces and also the parts in which they rest or move.

Undoubtedly the best type of hollow forging, and one which is gradually being introduced both for shafts and rolls, is where the walls are of the same thickness throughout, the outside and inside diameter varying together, both being greatest at the center, where the strength is required, and smallest at the bearings. Such a shaft is built on the principle of a girder, and offers the greatest strength for the least metal.

Prominent among hollow forgings are the Ferris wheel shaft, 32 inches outside diameter, 16 inches inside diameter, 45 feet long, weighing 89,320 pounds [the largest ever made]; and shafts for the steamers Puritan, Plymouth and Pilgrim of the Old Colony Steamboat Co., 20½ inches outside diameter, 12 inches inside diameter, and weighing 65,832 pounds each. Shafts for the navy are made hollow, and those for the International Line, for the steamers New York, Paris, St. Louis, and St. Paul, are 21 inches in diameter, crank pins 22 inches diameter, with a 10-inch hole through both. Field rings of nickel steel were hollow-forged for the 5,000 horse power Westinghouse dynamos at Niagara Falls, 11 feet 7⅜ inches diameter, 4¼ inches thick, and 4 feet 2¾ inches wide, weighing 28,840 pounds.

Thus it will be seen that there is scarcely any limit, either in length or diameter, to the proportions of forgings which can now be made by processes which have been perfected. In this, as in every other direction, the demand seems to have been more than met by the enterprise of the manufacturer, and engineers have a wide field opened before them for the display of their prowess, and it would seem as if they are rapidly taking possession of it.

Experiments have been made in the past few months, as a result of which the Metropolitan Traction Co., of New York, will be running cars with compressed air motors by July 1. Reservoirs with a capacity of 40 cubic ft. of air will run a car 16 miles an hour without counting stops.

A dispatch from Middlesboro, Ky., says that the basic open-hearth plant of the Watts syndicate will start up at once.

LAKE SUPERIOR IRON MINES.

The Auburn mine, reported recently as closed down, is in operation. Until the frost is thoroughly out of the ground, the milling process cannot be advantageously worked, and for the present the force consists of 60 to 70 men. In the winter the underground work employed 100 to 200 men.

The force at the Tilden mine is now 200 men, as against 500 early in the year. The Gogebic mines at Wakefield and Hurley are running with unchanged forces.

The new 65-ton steam shovel built by the Vulcan Iron Works, of Toledo, O., for the Consolidated Iron Mines, has has recently been transferred from Eveleth to the Mountain Iron mine and is now in operation. This machine is far in advance of anything the company ever used, both in strength and capacity. The car and frame is built en tirely of steel and iron of the best quality, and swings an unusually high crane, lifting the dipper 16 feet in the clear above the track, and has a very long reach. This crane swings easily and quickly and is loading 25-ton ore cars at the rate of 20 cars per hour, which is a car in 2½ minutes. This shovel can easily load 170 cars in a day of 10 hours.—[Virginian, Virginia, Minn.

Many of the mine managers are giving considerable thought to the eight-hour day. The Pittsburg & Lake Angeline Iron Co., the Cleveland Cliffs Co., Winthrop Iron Co., and the Aragon Mining Co., are now working the shorter day, the Aragon having begun a trial last week. The Lake Angeline was the first to inaugurate it several years ago. It is not yet satisfactorily determined by some of the companies that they are accomplishing as much as under the longer day. Figures are being obtained and careful comparisons are being made. These will be interesting when they are given out for publication.—[Iron Ore.

The Arcturus Mining Co., whose deposit is two miles west of the Mesabi Chief mine, has reached a depth of 140 feet in ore. Ten pits are down.

The Mahoning Ore Co. has four steam shovels at work, two in stripping and two in ore. Shipments are 2,500 tons a day.

Wall Street stock reports figure on 2,000,000 tons as the sales of the Minnesota Iron Co., for 1896, and the profit talked of is 75 cents a ton.

Mr. F. Braastad, of the Winthrop mine, informs us that his company has made but one small sale of ore as yet this season. They are doing good work in the open pit, and are also mining second-class ore in the south side workings. Mr. Braastad complains that the price for the non-Bessemers do not give a living to the company. Bessemers are bringing a fair price, but the non-Bessemers are suffering. It costs as much to mine and ship the poorer ores as it does the rich, and the difference in selling price is too great—at least the lower grades do not bring anything like what they should.—[Iron Ore, Ishpeming, Mich.

The Chicago & Northwestern Railroad is surveying a spur to the Hiawatha mine. The Hiawatha will begin shipping when the track is completed.

Some Foster ore has been sold and operations will be resumed at that property by the Cleveland-Cliffs Co.

The cargo of 4,569 gross tons of ore carried from Escanaba to Ashtabula by the Coralia, on her second trip, was only 45 gross tons less than the record-making cargo of the S. S. Curry, from Escanaba to South Chicago. It is to be considered that while the Coralia's draft was 15 feet 9 inches, that of the Curry put no limitation upon her.

The water has been pumped from the Mikado mine on the Gogebic range and operations will begin at once.

John Tod, president of the Bessemer Ore Co., operating the Biwabik; W. G. Mather, president of the Cleveland-Cliffs Iron Co., and W. D. Rees, president of the Republic Iron Co., and treasurer of the Lake Superior Iron Co., have been at the properties of their respective companies in the past ten days.

The explorations on the old Shaw lease, owned by the Security Exploration Co., are being continued and ore has been shown to a depth of 185 ft., covered by a surface of less than 30 ft. The lower deposits are of ore of high grade and very low in phosphorus. Several possible options have been talked of for the property, and the Minnesota Iron Co. is mentioned in this connection. It could work the property advantageously in connection with its adjoining Virginia mine.

On Saturday last Geo. Nichols' crew of the Drake & Stratton steam shovel No. 215 loaded 421 dump cars of dirt. The average is over 2½ yards to the car. This beats all previous records. On Tuesday of last week the same crew loaded 420 cars.—[Mesabi Range, Biwabik, Minn.

The night shift at the Biwabik mine will be discontinued, as the proposed output of 350,000 tons can be readily taken care of with two shovels, all day work.

The Prince of Wales shaft of the Queen Iron Mining Co., at Negaunee, idle for two years, started up last week. This resumption gives employment to 100 additional men.

Owing to the comparatively light demand for 1896 ores thus far, the management at the Norrie, East Norrie and Pabst mines, on the Gogebic range laid off 300 men on Monday.

ALTERNATING CURRENT FAN MOTOR.

The 1896 model alternating current fan motor of the General Electric Co. embodies many improvements. The most important is the universality of direction which can be given to draft caused by the revolving blades. The motor field frame being provided with trunions resting on a yoke, the current of air may be directed at almost any angle in a vertical plane, while the yoke is so set in the base that the motor may be moved through a complete circle horizontally and the current be directed toward any point, as desired. The yoke may also be removed from the base and inserted in a wall-bracket. The field is a ring, built up of thin iron punches, with inwardly projecting teeth, carrying the field wiring. The armature is a cylinder of iron laminations, with small, bare

copper rods running through the iron and terminating in copper discs fastened at the end of the core. There are neither brushes nor commutators, this small fan motor embodying principles similar to those involved in the large General Electric induction motors in operation in mills, shops and mines.

To reduce the friction of the starting and running current, the fan is provided with smooth-running bearings with hardened steel cones and balls. No oil is required to lubricate this bearing, and thus none can be thrown off. The fan motors herewith illustrated are wound for either 104 or 52 volts, and for frequencies of either 60 or 125 cycles. The fan and guard are nickeled, and the motor, yoke and base are black japanned. The diameter of the fan is 12 inches and the speed 1,800 revolutions per minute.

THE Mossberg Mfg. Co., of Attleboro, Mass., has passed into the hands of a syndicate of New York business men. Whether it will remain in Attleboro or not is an unsolved problem. It is said that if the business men of Attleboro will erect a suitable building for the use of the company, it would probably consent to remain. Such a building would cost from $50,000 to $75,000 and in case it should be undertaken the Mossberg Co. guarantees to lease the building for ten years and to pay a fair rate of interest as rent, with the option to buy the same at any time at an appraised value.

PLATE STRAIGHTENING ROLLS.

The set of No. 2. patented plate straighening rolls shown herewith was recently built by Hilles & Jones Co., of Wilmington, Del. This machine was driven by an electric motor with reversing rheostat, instead of the ordinary arrangement of pulleys or vertical engines. There are six rolls, each 10 inches in diameter, 74 inches between housings, made of hammered iron. There are three rolls above and three below and the arrangement of these is covered by letters patent. Two of the top rolls are placed midway between the lower rolls and are raised and lowered simultaneously by screws and gearing operated by the large hand or spanner wheel which is shown in the cut. The third top roll is separate and independent of the other rolls and is used as a compression or stretching roll, being placed directly above one of the bottom rolls, with independent vertical and lateral adjustment, each end independent of the other end. The object is to have the center lines of this compression roll placed somewhat out of line or across the center of the bottom roll, when so desired, thus bringing the heavy pressure in the center of the plate passing through or at any other point when necessary.

Having a lateral adjustment of three inches, this top roll can be brought to the front or the back of the bottom roll, which is a valuable feature in connection with the compression roll for doing a great variety of work, such as taking out buckles, stretching narrow plates and straightening plates that otherwise would be troublesome. The whole machine is mounted upon a heavy cast iron bed-plate, making the tool entirely self-contained. The Hilles & Jones Co. build a number of other sizes, both larger and smaller.

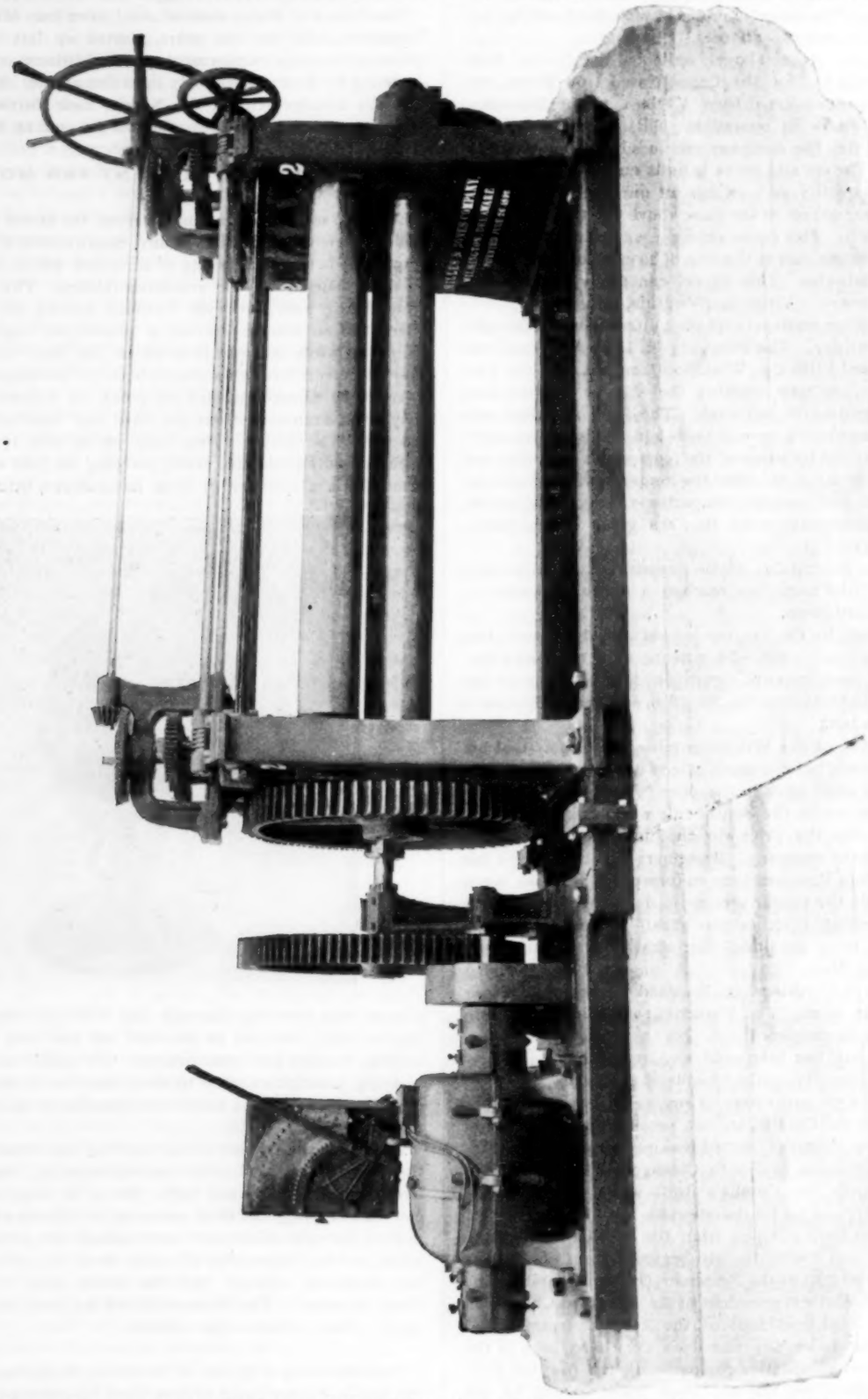


PLATE STRAIGHTENING ROLLS.

WESTERN FOUNDRYMEN'S ASSOCIATION.

The annual meeting of the Western Foundrymen's Association was held Wednesday evening, May 20, at the Great Northern Hotel, Chicago. The president, John M. Sweeney, occupied the chair. Those present were the following: John M. Sweeney, Chicago Consolidated Steel & Iron Co., Harvey, Ill.; C. A. Sercomb, Schwab & Sercomb, Milwaukee, Wis.; W. M. Moore, Joliet Stove Works, Joliet, Ill.; A. W. McArthur, Rockford Foundry Co., Rockford, Ill.; G. H. Carver, E. N. Erwin, Plano Mfg. Co., West Pullman, Ill.; F. M. Lyon, Burlington Route Foundry, Aurora, Ill.; Samuel Reid, American Well Works, Aurora, Ill.; G. M. Sargent, the Sargent Co.; James Frake; O. T. Stantial, L. W. Lukens, Illinois Malleable Iron Co.; H. S. Vrooman, Garden City Sand Co.; A. Sorge, Jr., M. E.; B. S. Summers, Western Electric Co.; F. G. Coffeen, Deering Harvester Co.; D. L. Cobb, H. A. Forsyth, Sloss Iron & Steel Co.; James Brady, J. W. Reedy Mfg. Co.; R. F. Palmer, *Industrial World;* A. M. Thompson, Link-Belt Machinery Co.; Wm. Ferguson, Gates Iron Works; D. De la Fontaine, Crane Co.; S. T. Johnston, Whiting Foundry Equipment Co.; B. M. Gardner, *The Iron Trade Review;* H. F. Frohman, J. M. Evans, S. Obermayer Co.; R. J. Cleveland, R. C. Barr, Cleveland & Barr; and G. C. Batten, all of Chicago.

President's Report.

The president read the following report:

The Western Foundrymen's Association, Chicago, Ill.:

GENTLEMEN: Inasmuch as with this meeting will likely be inaugurated those who are to succeed the present board of directors, president, secretary and treasurer of your association, it becomes me to transmit for record in the proceedings of these meetings a report of the conduct of affairs during the past year, and the present condition of the association.

In addition to the enumeration of such matters as have been accomplished, I desire to call the attention of the succeeding management of the association to one or two things which are in the nature of "line for future policy," without desiring more than to suggest for the consideration of the succeeding officers such things as seem at this time to be proper in the light of the past year's experience, and not in any sense offering to go beyond the idea of such suggestion.

One year ago, the officers installed at that time, found the association with an enrolled membership of 64. At the present time the enrolled membership is 114, showing an increase in enrolled membership of 50.

One year ago the financial condition of the association was as follows: Cash on hand, $40.86, while the liabilities amounted to $202. The financial condition of the association is now—cash on hand, $368.67, while there are no liabilities.

For the details of the cash transactions during the year, you are respectfully referred to the report of your treasurer submitted at this meeting. It seems to be an unwritten understanding, that the regular meeting of the association following the summer months should have some mark to distinguish it from the regular monthly meetings, and with this in view, it was determined to hold the meeting for last September at some other point than Chicago, in order to broaden the field of usefulness, as well as the acquaintance of and with the association, as fully as could be done by such a course.

It was therefore determined to hold the meeting of last September at Milwaukee, and not only have we to congratulate ourselves upon the success of the enterprise, but to remember with every pleasure, the open hospitality of the foundrymen of that city.

The success of this meeting was so pronounced, and the beneficial results to the association so evident, that there has been a unanimity of feeling on the part of the directors that the plan should be continued, and in order to give ample time for the diffusion of information concerning the next September meeting, your present board of directors, believing that it devolved upon them to take such steps as might be necessary, rather than to delay until the inauguration of the succeeding board, have determined and announced that the meeting of next September will be held at Cleveland, O.

The institutions of Cleveland, covering the manufacture in which we are interested, provide exceptional opportunities for an interesting visit, and I would now particularly recommend that the succeeding directors shall continue and expand the idea of holding at least one meeting annually in one of the cities inhabited by the members of the association.

One important feature inaugurated within the last year was the incorporation of the association under the laws of the state of Illinois, the adoption of new by-laws, and the change in the method of conducting the affairs, the substitution of a board of directors for what was previously known as the executive committee, and the appointment and induction into active service of an editing committee.

It may be that the near future will determine the necessity of some amendments to the existing by-laws, and it is to be hoped that each member of the association will apply himself personally to the consideration of such changes as may be conducive to the rapid growth of the association.

The thanks, not only of the officers and directors, but also of the members, are due the editing committee for the effective manner in which they have performed their duties, which must have been at the sacrifice of much time and personal interest, and I would particularly suggest to the succeeding directors and officers, that they do not allow the duties of the editing committee to become so onerous that it will be a hardship to undertake the work of a member of that committee.

Personally, I wish to extend thanks to the secretary for the very efficient service he has rendered this administration, as well as to the directors and members of committees for their kind attention.

There has been appointed under a resolution of the association passed at a recent meeting, a committee to report on the best method adapted to the regulatiou of apprenticeships. I look forward with much interest to the work of this committee, and trust they may receive every assistance within the power of our members in the work which is before them.

From foundrymen, whom this report may reach, and who are not thoroughly familiar with the objects of this association, I respectfully ask investigation.

Endeavoring to place foundry methods and management without the rule of thumb, by interchange of experiences and ideas, the proceedings of our meetings followed up and studied, must be pronounced of great benefit.

It has been, and is, the set purpose to lay an independent course, and set up a standard for technical work, clear of trade or commercial questions.

Respectfully submitted,

JOHN M. SWEENEY.

SECRETARY'S REPORT.

The secretary presented the following report:

The report of the secretary will be brief. The membership, a year ago, was 64. This evening we have on our roll 114, an increase for the year of 50. The interest shown in the meetings and work of the association has not been confined to our members, but has been manifested by foundrymen in all sections of this country, and even in Europe.

From time to time your secretary has received communications from foundrymen who were not members, commending in high terms the excellent work being done by this association. On several occasions we have received copies of English trade journals containing extracts of papers read at our meetings, but I regret to say proper credit was not always given either to the author or to the association. The topical questions have proved to be exceedingly popular and profitable, and it is to be hoped the members and foundrymen generally will continue to use this excellent medium to gain information.

The papers read before our association have been extensively published by the trade papers of this country, and in this connection, I think special mention ought to be made of the very great assistance given us by them in publishing notices of the meetings, and afterwards, in some cases, a very good report of our proceedings.

I would specially mention, *The Iron Age*, *The Iron Trade Review*, *The Foundry*, *The Age of Steel*, *The Engineering News*, *The Industrial World*, *The Journal of Commerce*, for the valuable space they have given us. *The Iron Trade Review* very kindly agreed to print our proceedings in pamphlet form, without any charge, such was its interest in seeing the association prosper, and I am glad to say it has fulfilled its promise very faithfully.

All the meetings have been held in Chicago, with the excep-

tion of the September meeting. On that occasion, we accepted the invitation of the foundrymen of Milwaukee, Wis., and went to that beautiful city, where we held a two days' session. Much good was derived from this special meeting and the association gained 15 new members.

The following is a list of the papers and discussions of the year.

June: Topical question: "What is the cause of small, round, clean holes in castings in the solid parts?"

Paper, "Cranes," by T. D. West.

July: "The Future of the Western Foundrymen's Aasociation," by H. S. Vrooman.

September: "False Economy in Foundry Equipment." by H. Hausen.

"An Example of Cost Sheets for Foundries," by A. Sorge, Jr., M. E.

October: "The Modern Jobbing Foundry," by Jas. A. Brady.

November: "Stretching Cast Iron and Elements Involved in its Contraction," by T. D. West.

"Properties of Cast Iron Shown by Keep's Cooling Curves," by W. J. Keep.

December: "Care of Patterns and Pattern Account," by P. S. Dingey.

January: Topical questions.—(1) Does the employer derive any benefit from compelling molders to remain in the foundry until quitting time, if their molds have been poured off before? If so, what benefit? (2) Are there characteristic conditions in foundries which necessitate different practice and management from those followed in other industrial pursuits? (3) Is a molder in fit condition to do further work after he has poured off his day's molding?

February: "Oil as a Fuel for Core Ovens," by H. Hansen.

March: Topical question.—(4) Is it desirable to have a recognized apprenticeship system, and, if so, what is the best form?

April: Topical question.—(5) Are foundries generally noticing an irregularity in the grading of foundry pig iron? If so, does the irregularity exist more generally in Northern than in Southern irons? Does it apply to both charcoal and coke irons, and in your opinion is any of the difficulty traceable to an extreme desire on the part of furnaces to supply their Bessemer pig iron trade at the expense of their foundry trade?

A committee consisting of Messrs. Ferguson, Oehring and Carver was appointed in March to investigate thoroughly the apprenticeship question and report at our September meeting.

A committee on headquarters for the association endeavored to make arrangements for a suitable place for this purpose but asked to be discharged for the present, pending action of another organization, which was done. This question will probably come up again.

Dues collected amounted to $1,021.25. The average attendance at our meetings was 38.

A new set of by-laws was prepared and adopted by the association Dec. 18, 1895.

The secretary desires to thank the officers, board of directors, editing committee and members for the very kind consideration shown him at all times, and for the assistance given in conducting the duties devolving upon him.

Respectfully submitted, S. T. JOHNSTON, Secretary.

TREASURER'S REPORT.

The treasurer submitted the following report:

Balance on hand May 15, 1895	$ 40.86
Indebtedness " " "	202 00
Receipts from " " " to May 15, '96	1,021.25
Expenditures from May 15, 1895 to May 15, '96	693.14
Indebtedness " " 1896	000.00
Balance on hand " " "	368.97

DETAIL OF EXPENDITURES.

Printing (old account)	$185 50
Previous Secretary's expenses	16.50
Printing and stationery	118.65
Postage	105.84
Stenographer	230.00
Exchange	3.85
Lunch and expenses	18.00
Miscellaneous expenses—Express, Telegrams, Telephone	14.80
Total	693.14

COMPARISON OF RECEIPTS AND EXPENDITUTES FOR YEARS ENDING MAY 15, 1896 AND MAY 15, 1895.

	May 15, 1896.	May 15, 1895.	Increase.	Decrease.
Total receipts	$1,062.11	$642.50	$419.61	.....
Total expenditures	693.14	608.50	84.61	.....
Balance on hand	368.97	40.86	328.11	.....
Liabilities	000.00	202.00	.....	$202.00

DETAILS.

	May 15, 1896.	May 15, 1895.	Increase.	Decrease.
Postage	$ 105.84	$169.65		$ 63.81
Stenographer	230.00	268.90		38.90
Printing and stationery	118.65	*241.45*		122.80
Miscellaneous, exchange, lunch, etc	36.65	114.00		77.35

*Note.—Of this amount incurred in 1895, $185.50 has been paid this year.

Respectfully submitted, O. T. STANTIAL, Treasurer.

The foregoing reports were accepted and ordered placed on file.

The following applications for membership were then submitted: South Pittsburg Pipe Works, South Pittsburg, Tenn.; W. A. Jones Foundry & Machine Co., Chicago; McDowell Steel Co., Chicago, and Sam'l H. Whitaker, of the Dayton Coal & Iron Co., Cincinnati. The applicants were elected members of the association.

The election of officers for the ensuing year was then in order.

A. Sorge, Jr., M. E., was elected president, but resigned in a short speech in which he heartily thanked the association for the high compliment paid him, but stated that he thought he could serve the association better out of the presidential chair than in it. His resignation was accepted.

The meeting then adjourned and a meeting of the board of directors was called at once. At this meeting the officers qualified as follows: President, A. W. McArthur; vice-president, Wm. Ferguson; secretary, A. Sorge, Jr., M. E.; treasurer, O. T. Stantial; directors: J. M. Sweeney, W. M. Moore, C. A. Sercomb, S. T. Johnston, G. H. Carver.

Editing committee: B. M. Gardner, J. K. Mackenzie, H. S. Vrooman.

The meeting then adjourned.

Steel Pipe for Lightness.

One of the greatest developments that have lately taken place in this country has been the increased production of steel pipes in the place of pipes of cast iron. This has been largely due to the extension of mining abroad, particularly in Australia and South Africa, where it frequently happens that deposits of great value occur in inaccessible places, where there is an absence of water. These two conditions have made light steel pipes a necessity, and engineers are now able to obtain, at much lower cost than cast iron pipes, in such cases feather-weight pipes, lap-welded, of mild steel. Steel pipes to withstand working pressures of 500 feet head have been supplied from 12 inches diameter of no greater thickness than No. 12 wire gauge, weighing for a 12-inch pipe no more than 39 lbs. per yard, as compared with the weight of a 12-inch light cast iron pipe of 247 lbs. per yard; 25 inch pipes have been made 3-16 inch thick, and in one instance the weight was 132 lbs. per yard, as against 784 lbs. for the lightest cast iron pipe, equivalent to one-sixth. In the case of a recent order for the Buluwayo waterworks, the carriage of steel pipes was £10 per ton, and the actual saving by using steel pipes was 73½ per cent. of the estimated cost of cast iron. —[London Iron and Coal Trades Review.

E. W. PARKER, statistician of the United States Geological Survey, has completed the compilation of the statistics of coal production in the United States during the calendar year 1895. The total output from all mines was 171,804,742 long tons, or 192,421,311 short tons, having a total value at the mines of $197,572,477. The output of anthractite coal in Pennsylvania increased from $46,358,144 long tons in 1894, to 51,785,122 long tons in 1895, a gain of over 5,400,000 tons. The product of bituminous coal increased from 118,820,405 short tons, in 1894, to 134,421,974 short tons in 1895. There was an increased production in all but five of the 29 coal-producing States. The States in which a decreased product was shown were Georgia, Kansas, North Dakota, West Virginia and Wyoming. The principal loser was Kansas. The product among the other leading coal States was: Illinois, 17,735,864, value $14,239,157; Ohio, 13,376,137, value, $10,637,553, and West Virgina, 11,424,863, value, $7,787,120.

THE Standard Car Wheel Co., of Cleveland, has been incorporated in Ohio with a capital stock of $75,000. The incorporators are N. P. Bowler, of Bowler & Co.; C. A. Brayton, formerly of Maher & Brayton, W. L. Bowler, W. B. Brayton and Francis J. Wing. The new company acquires the car wheel foundry of Bowler & Co.

CUPOLAS AND CUPOLA PRACTICE UP TO DATE*

BY DR. EDWARD KIRK.

There are three kinds of furnaces employed in the melting of iron for foundry work. They are known as the pot furnace, reverberatory furnace and cupola furnace. These furnaces differ from each other in construction and principle of melting and in the days of poor fuel their employment in the melting of iron for special work was considered necessary to the production of good castings. But with the discovery of veins of coal more suitable for melting and with the advancement made in the manufacture of coke, the amount of deterioration of iron by impurities in the fuel has been reduced to a minimum, and the furnace that will melt with the smallest per cent of fuel has been almost universally adapted as a foundry furnace, while the fuel that melts iron most rapidly has almost entirely taken the place of other forms. Charcoal, the furnace fuel of years ago, is only used in foundries located in isolated districts, where other fuel is not obtainable. The use of hard coal in melting is almost entirely restricted to the anthracite coal fields, and coke has become the universal fuel for foundry work.

In the pot furnace one ton of coke is consumed in melting a ton of iron (2,240 lbs.). In the reverberatory furnace, from 10 cwt. to 20 cwt. of coke is required to melt a ton of iron. In the cupola furnace, a ton of iron may be melted with 172 lbs. of coke. It will thus be seen that the cupola melts iron with a smaller per cent. of fuel than either of the others. To melt in a cupalo with the small amount of fuel stated, the cupalo must be properly constructed and managed. This is not always the case, and the consumption of fuel, as a rule, is is much greater, but is still not so great as required in either of the other furnaces. To reduce the amount of fuel required to the smallest possible amount, a cupola must be of a size that will admit of running it to its fullest capacity in melting a heat. The tuyeres must be placed low, to prevent wastage of fuel in the bed, and the charging aperture must be placed high, to utilize all the heat of the fuel in heating the stock and preparing it for melting before entering the melting zone.

The rule for charging a cupola is to place three pounds of iron upon the bed to each pound of fuel placed in the bed, and 10 pounds of iron upon the charges of fuel to each pound of fuel in the charge. This rule is not always followed accurately, but it is approximately followed, and when a cupola is so large that the entire heat is melted upon the bed in one charge (according to this rule) only three pounds of iron is melted to the pound of fuel. When ten charges are melted in the same cupola, with the same bed, eight pounds of iron are melted to one of fuel. The greater the number of charges the less per cent. of fuel required in melting, and it is only by melting a large number of charges and keeping the cupola in blast for a great many hours that the small per cent. of fuel I have stated as sufficient to melt a ton of iron can be realized.

Foundrymen, as a rule, cannot have their cupolas in blast all day, and are compelled to use large cupolas to melt the amount of iron required for their work in a given time. Others prefer to melt their iron rapidly; and it is a question for each foundryman to decide for himself whether it is more economical to use a large cupola in melting and save time, or a small one and save fuel in melting.

Tuyeres should be placed from two to six inches above the sand bottom, and the height they are placed is from two inches to six feet. The general height for heavy work is from 18 to 36 inches. The placing of tuyeres at so great a height is productive of great waste of fuel. The function of fuel placed below the tuyeres is to support the stock in a cupola. It takes no other part in melting and is not consumed in melting the longest heats. Its temperature, when a cupola is in blast, is below that of the melting zone, and molten iron in its descent through the fuel in a large bed to the bottom of a cupola is not superheated. The temperature of such iron is so reduced that hot iron can only be tapped from a cupola with high tuyeres when the molten iron passes down through the fuel under the tuyeres in such a large volume and so rapidly that it is not chilled in its descent.

While the fuel placed under the tuyeres is not consumed in melting, it is heated to so high a degree and ground up to such an extent in the dump, that it is rendered worthless as a cupola fuel. Thus every pound of unnecessary fuel placed in a cupola by using high tuyeres is a waste. It is claimed by many foundrymen that it it necessary to have tuyeres placed high to collect and keep iron hot for a large casting. This is one of the fallacies handed down to us by our forefathers in the foundry business. Iron can be drawn from a cupola with low tuyeres so much hotter that it can be kept in a ladle for any given length of time, when properly taken care of, at a higher temperature than is possible in a cupola with high tuyeres.

In all cases, tuyeres should only be placed at a sufficient height above the sand bottom to admit of molten irons mixing for hand-ladle work, and to give sufficient time between taps for removing and replacing large ladles for heavy work.

Low charging doors are another legacy from the olden time. The volume of heat escaping from low cupolas was so great that many attempts were made to utilize the waste heat for supplying cupolas with a hot blast. Other attempts were made to divert the heat into side chambers for heating the iron prior to charging, but this feature of the old cupolas has been displaced more rapidly by modern ideas than the high tuyere. Cupolas in which charging doors were formerly placed six to eight feet above the bottom, now have them placed 10 to 15 feet above, and even higher; and all the heat that escaped from the low cupola is now utilized in heating stock in the cupola, prior to melting.

The highest cupolas in use at the present time in this country are those of the Carnegie Steel Works, Homestead, Pa. The charging apertures in these cupolas are placed 30 feet above the iron bottom. The heat is employed to so great an extent in heating stock prior to melting that it has not been found necessary to line the stacks. The heat escaping from the cupolas, even when the stock is low, is not sufficient to heat the iron stacks. A cupola must not only be properly constructed to do economical melting but it must be properly managed. In every cupola there is a melting zone or belt in which iron is melted. Above or below this zone it cannot be melted in a cupola; but it may be melted on the upper and lower edge of the zone, and in either case a dull iron is the result. The exact location of the melting zone is determined by the volume of blast. A large volume places the zone a few inches higher, and a small volume puts it a few inches lower. For this reason cupolas of exactly the same construction frequently have higher and lower melting zones and require a greater or less amount of fuel for a bed. The size and arrangement of tuyeres often increase or diminish the depth of a melting zone; to obtain the best results in melting, the location and depth of the melting zone must be learned and the weight of the bed and charges varied accordingly.

The top of a melting zone may be readily determined by the length of time required to melt iron after the blast is put on. If iron comes down in five or ten minutes the iron on the bed has been placed within the melting zone. If iron does not come down for 20 or 30 minutes after the blast is on, the iron has been placed above the melting zone by too great a quantity of fuel in the bed and the delay in melting is due to the time required to remove the surplus fuel by burning it away. If iron comes down in five or ten minutes and is dull and at least three pounds of iron can not be melted to one of fuel in the bed before iron comes dull, the bed is too low and the iron was not placed at the top of the melting zone, when melting began. By noticing the melting in this way the height of the zone can readily be found and the exact amount of fuel required for a bed determined.

The depth of the zone can be found by increasing the weight of the first charge of iron until the later part of the charge comes dull, which indicates that it is being melted too low in the zone and the charge should be decreased a few hundred weight. The quantity of fuel required for a bed and the amount of iron that can be melted upon it having been determined, tests are then made to ascertain the amount of fuel required in the charges and the amount of iron that can be meted upon each charge.

The amount of fuel required in each charge is the amount that will restore the bed to the same height above the tuyeres that it was before melting the first charge. This is found by

* Prepared for the National Convention of Foundrymen, Philadelphia, May 12-14, 1896.

increasing or decreasing the fuel until the melting becomes continuous and there is no variation in the temperature of the iron at the end of each charge. A stoppage or slacking in the melting indicates that the charge of fuel is too heavy and the iron upon it is placed above the melting zone. Dull iron at the latter end of a charge indicates that the charge of iron is too heavy and so on throughout the heat. By carefully noting the melting in every part of a heat, the peculiarities of any cupola in melting may be readily learned and a large amount of fuel saved.

These rules for melting are not always followed and in nine cupolas out of ten too great an amount of fuel is consumed. It is a common practice of melters gradually to increase the fuel in charging. When iron comes dull they attribute it to poor fuel or not enough of it. In either case more fuel is the remedy applied and as a rule dull iron and slow melting are the result. Fast melting and hot iron are not possible with too large a quantity of fuel in a cupola. The reason for this is that with an excess of fuel the iron is placed above the melting zone and the extra fuel must be consumed before iron can come within the zone. The result is slow and irregular melting.

Iron held just above the zone for any length of time is heated to such a degree that when it enters the melting zone it melts rapidly in one mass and its descent through the melting zone in a molten state is so rapid that it is not superheated and drops through to the bottom of a cupola a dull iron. Slow melting is always the result of an excess of fuel and dull iron is more often the result of an excess than of a deficiency of fuel.

The per cent of fuel required in melting when a cupola is properly constructed and managed depends entirely upon the length of time required to melt a heat. In short heats of two or three hours eight pounds of iron to one of coke may be melted and good hot iron made for light work, by careful management. The melting generally done in heats of this length is between six and seven to one. In long heats 13 to one has been melted. But this ratio is seldom maintained for any great length of time in cupolas, for the quality of fuel varies and foundrymen would rather use a little extra fuel than take chances of a bad heat. In heats requiring from one to six days to melt, the average melting is about 10 to one.

It should be the aim of every foundryman to reduce his melting to a system. He should first see that the cupola is properly constructed, and then study its working in the manner I have described. When this has been learned, a slate should be made out and given to the melter, indicating the exact amount of fuel to be placed in the bed and charges and the exact amount of iron to be placed in each charge, also the amount of each brand of iron or scrap to be used. As the lining burns out and the cupola diameter increases, the weight of charges of fuel and iron should be increased to correspond with the enlargement of the cupola. An accurate cupola record should be kept, and the amount of fuel consumed in melting compared with each carload or lot of coke, to make sure that no extra fuel is being used by the melter. When such an account is accurately kept by every foundryman, the average of fuel consumption will be much less than it is to-day.

JOHN J. WILLIAMS, of Youngstown, O., who has worked for 18 years as a puddler, has been at work in the past few years on a miniature rolling mill, which has just been completed. The squeezers, roughing and finishing trains, etc., all of iron, are produced on a small scale, the mill, with engines and the boiler plant, taking up one room in the maker's house. There are seven engines, all of them made by Mr. Williams. One of these, a Hamilton reversing engine, has 150 pieces. The iron for the castings involved in the work was melted in a small cupola, and all patterns were made by the patient inventor.

UNDER the agreement entered into by the chain manufacturers of the country, as noted in these columns recently, an advance of 10 to 12 per cent has been made, and at a meeting to be held next week the advisability of a further advance will be discussed. Jones & Laughlins are the principal chain manufacturers in the Pittsburg district.

THE repairs to the engine of the Ohio Steel Co. will probably be finished next week.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants :—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

E. A. Sanders and J. C. Albright, of Saginaw, Mich., have formed a partnership to carry on a galvanized iron roofing business under the firm name of the Saginaw Cornice Works.

The city of Pittsburg will advertise for bids for two large iron bridges, to be built at once in Schenley Park. The combined cost is estimated at about $400,000.

The Turivas-Wagner Iron Co. has been incorporated at Chicago, with a capital stock of $2,500, to conduct a general iron business, by Lewis Turivas, Adolph Wagner and Joseph A. Culkin.

The Paige Journal Box & Roller Co. has been incorporated at Chicago, with a capital stock of $50,000, to manufacture machinery, by William E. Paige, Oliver A. Forsyth and James R. Smith.

A number of Washington, Pa., leading business men have formed a company for the manufacture of steel implements. The capital stock is $20,000. James A. Little is president; A. W. Pollock, secretary and manager; W. H. Boreland, treasurer.

The Houghton & Buxton Mfg. Co. has been incorporated at Worcester, Mass., to manufacture cold-drawn steel fittings for bicycles and sheet metal specialties. The plant will contain 7,000 feet of floor space at 89 Exchange st. It has an equipment of all new machinery of the latest design and construction. An Allen improved 20 h. p. high-pressure boiler, has just been set up. The company expects to be ready for operations about June 1. The officers are: Lewis T. Houghton, president and treasurer; William H. Buxton, vice-president and general manager, and Thomas Prince, secretary.

New Construction :—

A new flint glass works is to be built at Bellaire to cost $60,000.

The Allegheny County Light Co. will erect a new dynamo and engine room at a cost of $47,000.

The H. A. Lozier Co., bicycle manufacturers, will erect an immense tube works at Greenville, Pa. The plant will employ about 500 men.

The Akron, Bedford & Cleveland Railway will build at Cuyahoga Falls, O., a repair shop for its electric equipment It will be 55x65 feet.

The Senate Committee has reported favorably on the proposed new bridge over the Monongahela River at Braddock, to be built by the Braddock & Duquesne Bridge Co.

The Kelly & Jones Co. has let the contract for the construction of a 120x40 foot brick addition to its works at Greensburg, Pa. About 100 extra hands will be employed.

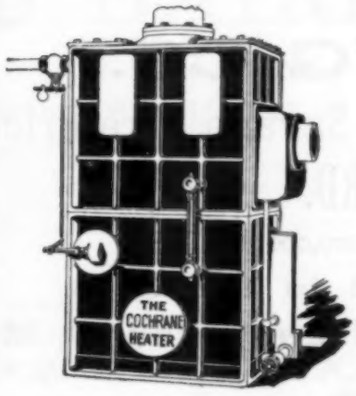
The Hydraulic Machine Co., Pittsburg, will erect a new foundry 150x100 and costing about $8,000. Tue same company will build an engine room and power house costing $1,000.

The foundry of the new oil well machinery plant, to be built by Geo. B. Sennett, of Meadville, Pa., and others, at Youngstown, O., will be 175x75 feet, and the machine shop 225x60 feet. The foundry will have a daily capacity of 38 tons of castings.

The Youngstown (O.) Bridge Co., secured the contract for the new bridge over the Tennessee River at Knoxville, Tenn. The cost will be $210,000. The total length with approaches is 1,700 feet with five spans over the river. The bridge will be paved with cement paving and corrugated trough floor, manufactured by the Youngstown Iron & Steel Roofing Co.

The new plant of the weldless tube works, at Newark, O., will consist of seven buildings, including an open-hearth steel works 70x120, a sheet rolling mill 120x400, and two weldless tube works each 80x235. The shops will cover 12 acres of ground. The stockholders include ex-Gov. Campbell, E. N. Hatcher, of Columbus; Dr. Hart, Wooster; George H. Everson, Dr. S. B. Bishop, W. P. Moreland and Dr. Howells, of Pittsburg.

About 53,000 feet of land on Cambridge street, near Webster square, Worcester, Mass., has been purchased by the Curtis &



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Manufacturers of the
COCHRANE HEATERS,
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WHARTON-HARRISON SAFETY BOILERS.

Marble Machine Co., which will build at once a new plant. It is expected that the factory will be ready for occupancy about Dec. 1. The main building will be of brick, three stories above above the basement, 230x64 feet; also power and boiler house, 75x40 feet; blacksmith shop, pattern house, storehouse, lumber sheds, etc., will be erected.

Additions, Enlargements, Removals, Etc.:—

R. M. Clough, New Haven Conn., manufacturer of metal-working tools, will soon add to the equipment of his shop and extend his line of tools.

The Kelly & Jones Co., Greensburg, Pa., are making additions which will considerably increase their capacity. The increase will require 200 additional men.

Kilborn & Bishop Mfg. Co. has purchased from the Miner & Peck Mfg. Co. its drop forging department, and will continue this part of the business at the same location. Miner & Peck Mfg, Co. will soon locate elsewhere, and with increased facilities will continue the manufacture of the Peck drop press and M. & P. friction drop-hammers.

The Anderson Bicycle Wheel Co., formerly the Hartford Wheel & Machine Co., is removing from Morrow, O., to Anderson, Ind. It is erecting buildings specially adapted to its purposes, into which the machinery will be removed as soon as completed. The company will make a high grade bicycle under the name of Sheridan, but also expect to manufacture motocycles. It is experimenting on aluminum wheels for light vehicles.

Fires and Accidents:—

The Aultman & Taylor Co.'s warehouse, at Mansfield, O., containing a large stock of threshers and separators, was struck by lightning, May 25, and in an hour was completely destroyed, with contents. The fire was kept from the adjoining shops. The loss is heavy, but is covered by insurance.

General Industrial Notes:—

The Valentine Iron Co., Bellefonte, Pa., will erect a saw mill, to employ 100 men.

The Wilkes Rolling Mill, at Sharon, Pa., which has been idle for some time, has resumed operations.

The rolling mills of Irondale, O., after a long shut down, resumed May 25, and expect to be busy until August.

The Brown-Bonnell Iron Co., Youngstown, took an order last week for 200 tons of charcoal iron, to be shipped to Cincinnati, for building purposes.

The Chicago West Park Commission has given a contract to the Whiting Foundry Equipment Co., of Chicago, for a pulley block traveling crane and tracks.

The Chicago Pneumatic Tool Co. is now shipping 300 of its largest size machines to Europe. It has recently put on the market the Manning piston air-drill.

Receiver and Vice President Murray, of the B. & O., says specifications are now being drawn for the engines, freight and passenger, which it is expected to buy. It is believed the application for permission to issue $5,000,000 receivers' certificates for improvements and general overhauling of the equipment will be granted. The court will also be asked to sanction an issue of $3,400,000 car trust certificates.

All the four black plate mills of the La Belle Iron Works, Wheeling, W. Va., have been started into full operation after running only partially for some time.

The Canton Steel Co., Canton, O., discharged several of its employes who were leaders in organizing the men for a strike. Many others went out on a sympathy strike.

The Specialty Mfg. Co., of Allegheny, Pa., has completed a 22-ton electric crane, equipped with Westinghouse motors, for the continuous mill of the Schoenberger Steel Co.

The largest record of finished plates for the universal mill of the Pottstown, Pa., Iron Co. was made in April, namely 3,185 tons. The April output of all departments was 8,000 tons.

The Goubert Mfg. Co., of 14 Church st., New York, has just opened a western office in the Monadnock Block, Chicago, in charge of E. Webster, who is an expert in the matter of steam appliances.

The Curtis Mfg. Co., of Alton, Ill., manufacturer of wagons, machinery, etc., has assigned. The assets are estimated at $2,738, and liabilities $8,408. The principal creditor is W. L. Curtis, the lagest stockholder in the concern.

A shipment of 500 tons of light steel rails was recently made to Japan from the Bay View, Wis., works of the Illinois Steel Co. The rails were sent by lake to Buffalo, there transferred to cars for New York and then loaded on a steamer for Japan.

Stock market reports say that there has been an absorption of a considerable amount of floating Colorado Fuel & Iron Co. stock recently. A dividend on the commou stock in August is said to be a probability, if the present volume of business keeps up.

John H. Blackwell and W. H. Grady, two of the bondholders of the Vanderbilt Steel & Iron Co., Birmingham, Ala., have bought in the furnace and site for $10,000. There were $65,750 bonds outstanding. The furnace will probobly be sold to the Sloss Iron & Steel Co.

The Ohio Tube Co., Warren, O., re-elected O. C. Barber, president. E. B. McCrum, Jr., resigned as general manager, and D. P. Wheeler, of Akron, O., was elected his successor. F. M. Peete, of Alliance, O., was elected treasurer, and Thos. J. Bray, secretary and superintendent.

The Ferris wheel, so conspicuous at the World's Columbian Exposition, has been re-erected in the northern part of Chicago, not far from Lake Michigan. The company operating it is composed of substantially the same stockholders as during the World's Fair. Robert W. Hunt is president.

The newly elected officers of the Wellman Steel Co., Chester, Pa., are: President, Wm. Burnham; secretary, D. G. Stokes; treasurer, J. Tatnall Lea. Board of Directors: Wm. Burnham, J. Tatnall Lea, E. H. McCullough, David Williams, Joseph Storm Patterson, Richard Peters, Jr., S. T. Wellman.

Regarding the rumors current in Chicago recently as to the financial standing of John Featherstone's Sons, of that city, Geo. F. Featherstone, president, and Arthur J. Featherstone, secretary and treasurer of the company, say in a card, dated

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is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

May 25, that Judge Hanecy refused to appoint a receiver, and has left the affairs of the company in the control of its officers in the same manner as before the application made by the Equitable Trust Co.

The South Boston Iron Works, at Middlesborough, Ky., are to be taken hold of by the Middleborough Engineering Co., which has been incorporated by English capitalists. The capital stock is $500,000, and $150,000 of this will be retained as working capital. Two traveling cranes will probably be added. Operations are to begin July 1. Castings up to 30 tons can be handled. A. E. Manchester, of Newburgh, N. Y., will manage the business.

The Bessemer Coke Co., of Pittsburg, has made application for a charter of incorporation. The incorporators are: Wallace H. Rowe, Joshua W. Rhodes, William Y. Humphreys, Robert L. Martin and Humphreys, Stewart & Co. The new concern will operate in Unity Tp., Westmoreland Co., Pa.; near the terminus of the southwest branch of the Pennsylvania Railroad, where it has acquired a large acreage of standard Connellsville coal lands.

The Carnegie Steel Co., nearly two years ago, investigated the merits of the Cahall vertical water tube boiler, and put in a trial plant of 200 h. p. at its gas pumping plant at Bagdad, Pa. About a year later the company put four of these boilers at its Edgar Thomson Steel Works. After careful tests of these boilers, under varying conditions, arrangements have been made to tear out all the old style boilers at Furnaces A, B and C at Edgar Thomson, and install the Cahall boilers.

The diversity of uses to which electric motors are now being put is illustrated by the orders which the power and mining department of the General Electric Co. received in the first two weeks of April. Motors were called for to operate printing presses, saws and planers in a box factory, an assortment of mining machinery in a coal mine; machinery in a large bakery; blowers in a stove works; a Gould fire pump; a mine pump; large Brush arc lighting dynamos; a jib crane; traveling cranes machinery in an oil cloth works; inclined railway, etc.

The Lehigh Valley has ordered 25 freight and five passenger engines, from the Baldwin Locomotive Works. The Southern Railway has placed orders for six freight engines with the Brooks Locomotive Works, and for four with the Pittsburg Locomotive Works. The Texas Pacific has ordered

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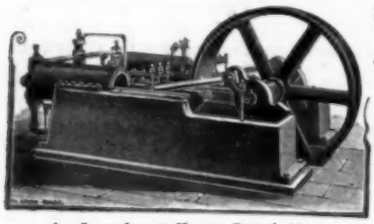
1—36x36x18 ft. Sellers Planer.
1—36x36x20 ft. N. Y. Steam Engine Co. Planer.
1—16x18″ Lathe & Morse Crank Planer.
2—15″ Hendey Shapers.
1—15″ Youngson Shaper.
1—15″ Smith and Mills Shaper.
1—10″x5′ Prentice Engine Lathe.
1 each 14″ and 15″x6′ Ames Engine Lathe.
1—16x5 ft. Bullard Engine Lathe.
1—18x8 ft. L. W. Pond Engine Lathe.
1—24x8 ft. Phillips Engine Lathe.
1—24x14 ft. Lathe & Morse Engine Lathe.
1—38x14 ft. New Haven Engine Lathe.

AND MANY OTHERS.

We have all the best makes of New Tools. Send for Second-Hand List.



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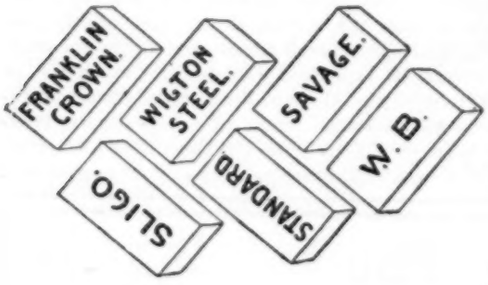

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300 freight cars from the Mount Vernon Car Mfg. Co. The Central Vermont receivers have petitioned the court to purchase 2,500 tons of steel rails to cost $75.000, to purchase ties costing $100,000, to complete the building of bridges at large expense, and to purchase new passenger equipment to cost $67,500.

UNIFORMED ATTENDANTS.

For Eastern Passengers via Pennsylvania Lines.

A uniformed parcel porter service was recently established at the Jersey City passenger station of the Pennsylvania Lines. The duties of these porters are to look after the comfort of all arriving and departing passengers over the Pennsylvania System, and to accompany them (if desired) between Cortlandt street ferry, New York City, and the American Line Pier, Sixth Avenue Elevated Railroad, and the Central Railroad of New Jersey Station; also between Desbrosses street ferry, New York City, and the Ninth Avenue Elevated Railroad.

The uniformed parcel porter service has just been extended to the Philadelphia Broad street passenger station of the Pennsylvania Lines, where porters will meet all trains and assist passengers who may desire their aid; take charge of rolling chairs when needed; meet carriages and make themselves generally useful to passengers. They will be in attendance from 6 A. M. until 12 midnight, and when accompanying passengers will carry parcels and hand baggage.

They are not permitted to charge for this service, nor to intimate in any way that a fee will be expected. Any recognition of their assistance must be in the nature of a positive gratuity, entirely optional with the person served.

ANNOUNCEMENT was made recently that the Buffalo Forge

Co. had obtained contracts for the blowers and engines required for torpedo boats Nos. 3, 4 and 5, also Holland torpedo boat, building by the Columbian Iron Works and Dry Docks Co., also for revenue cutter No. 2, building by Atlantic Works, for the government. The same company has since obtained the order from Moran Bros. & Co., Seattle, Wash., for torpedo boat No. 8, U. S. N. Four blowers, with compound engines on each, are required for the above boat.

CHAS. H. MUNGER, who has been superintending mining operations on the Mesabi range, has been made superintendent of the Norrie and other properties of the Metropolitan Iron & Land Co., succeeding the late Capt. J. D. Day.

Pittsburg Saengerfest Excursions.

June 6, 7 and 8, are dates upon which excursion tickets to Pittsburg will be sold via Pennsylvania Lines for the North American Saengerfest. Return limit, June 13.

A BILL has been filed at Chicago to foreclose a $300,000 trust deed on the property of the Calumet Iron & Steel Co., at South Chicago. The trust deed dates from February, 1888, when the company issued $300,000 worth of bonds. The complainants, most of whom reside in Cleveland, are Charles A. Otis, Eva Ingersoll Brown and W. H. Brown, trustees under the will of Augusta Brown; A. M. White, Mary Dwight Foote, Mary Witt Eells, Eliza A. Witt, S. W. Eells, Elizabeth G. Newberry, Columbus R. Cummings, James M. Flower and the Union National Bank, who are the holders of $213,000 of the bonds. The holder of the trust deed is the Illinois Trust and Savings Bank. The court is asked to appoint a receiver and sell the property. No interest has been paid since February 1, 1895. The property consists of a valuable tract of land with docks on the Calumet river, a rolling mill and cut nail factory and blast furnace. The furnace has until recently been operated under lease.

Prohibition National Convention Excursions to Pittsburg.

Excursion tickets to Pittsburg, account Prohibition National Convention, will be sold via Pennsylvania Lines May 24, 25 and 26; good returning until May 30. Particulars about rates and time of trains may be secured by addressing Pennsylvania Line ticket agents.

THE corporation of John Featherstone's Sons, operating the Columbia Iron Works, in Chicago, has been attached by the Equitable Trust Co., also of that city, which claims to be a stockholder and demands an accounting. The foundry corporation was organized in 1891 with a capital stock of $600,000, to conduct a business established by the late John Featherstone and which he had made very profitable. He made a specialty of railroad work. The complaining company became interested in 1893, when one of the sons transferred to it all his property to provide an income for his wife and children. Since then it is alleged that no dividends have declared nor paid, but that large sums have been misappropriated.

Democratic National Convention Excursions to Chicago.

Tickets to Chicago will be sold at reduced rates via Pennsylvania Lines July 3, 4, 5 and 6; good returning until July 12; details may be obtained by applying to Ticket Agents of Pennsylvania Lines.

LACHINE Rapids, of the St. Lawrence, are at last to be utilized. For some time past work has been carried on by the Lachine Rapids Hydraulic Co. upon a large wing dam which runs out for more than 1,000 feet into the St. Lawrence river. A fall of water is thus secured sufficient to develop, at the low water season, 15,000 h. p. This water power is to be transformed into electricity. Upon the dam a power house will be built which will run its entire length and show an unbroken interior of 1,000 feet long. The basement will be occupied by the water wheels from the Stilwell-Bierce and Smith-Vaile works, at Dayton, O. The main floor will contain the dynamos, of which there will be 12, each of 1,000 h. p., or 12,000 h. p. in all. They will be of the General Electric Co.'s latest multiphase type, and will generate current for transmission to Montreal for use there in lighting the city, operating the street railroads, and in any and all other lighting and power purposes.

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The contract for this installation is the largest ever placed at one time for electric dynamos. It was competed for by every prominent electrical manufacturer in the world.

Christian Endeavor Washington Excursions.

Low rate tickets to Washington account Christian Endeavor Convention will be sold via Pennsylvania Short Lines July 4, 5, 6 and 7; good to return until July 15, with privilege to extend limit until July 31. See Pennsylvania Line Ticket Agents for details.

THE first steel beam rolled by the Universal Construction Co., of Chicago, was turned out May 20. The beam is a 12-inch one, and was rolled in the North Chicago rolling mills of the Illinois Steel Co., now operated by the Universal Construction Co. Beams, columns, girders, and all kinds of steel structural material will be manufactured. For three years the mill has been closed, but was put in shape six weeks ago, and now is ready to run full. It is the only structural mill now running west of Cleveland.

St. Louis Excursions for Republican National Convention

June 12, 13, 14 and 15, via Pennsylvania Lines; good returning until June 21. Rates and time of trains may be obtained of Pennsylvania Line Ticket Agents.

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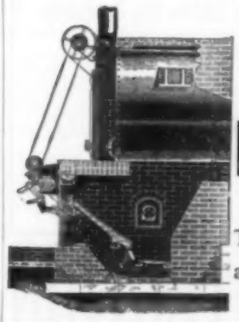
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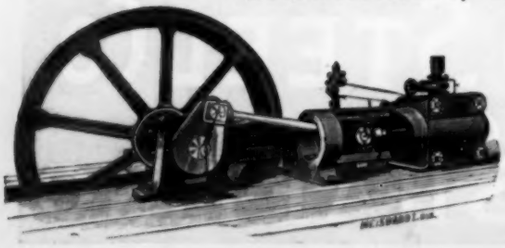

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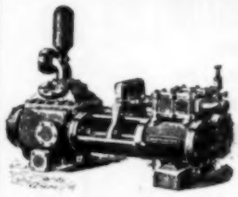

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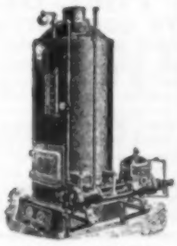

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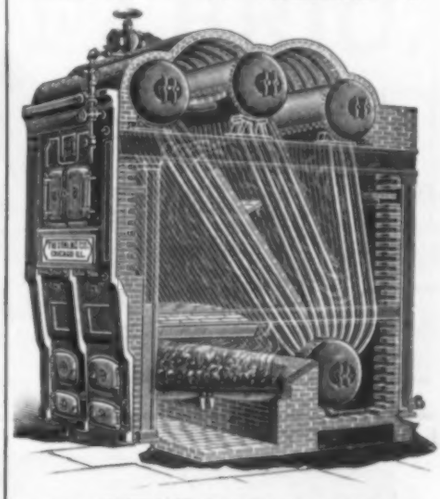

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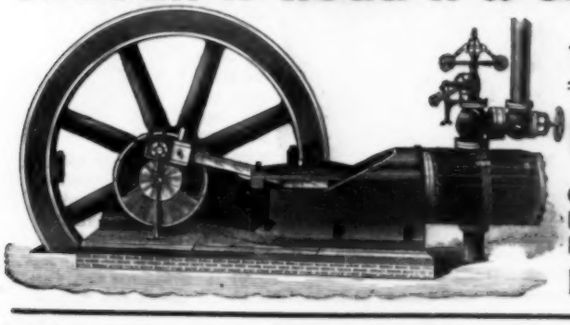

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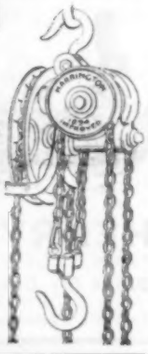

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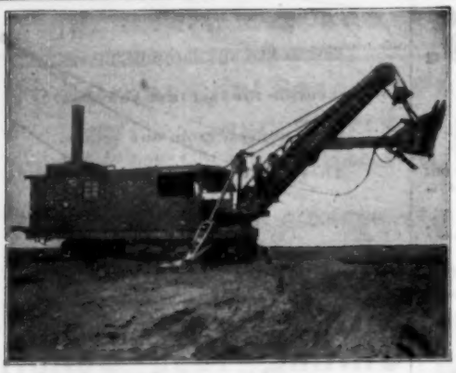

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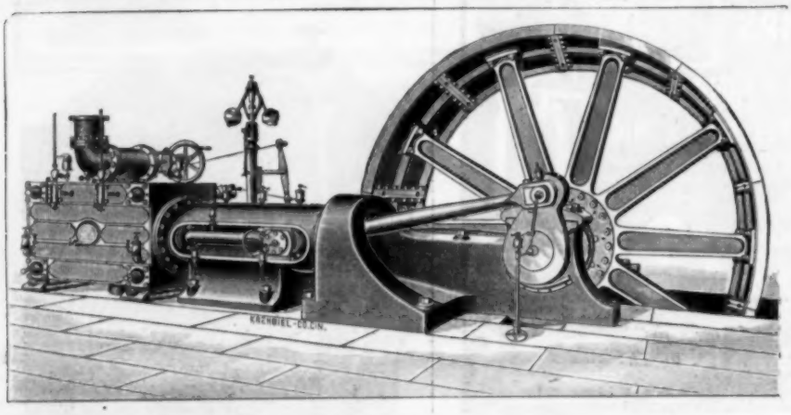

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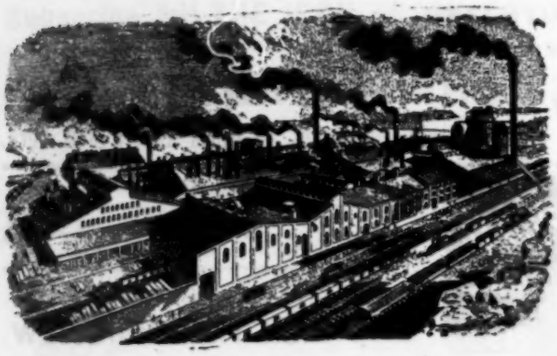

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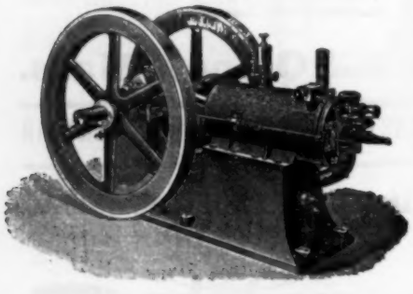

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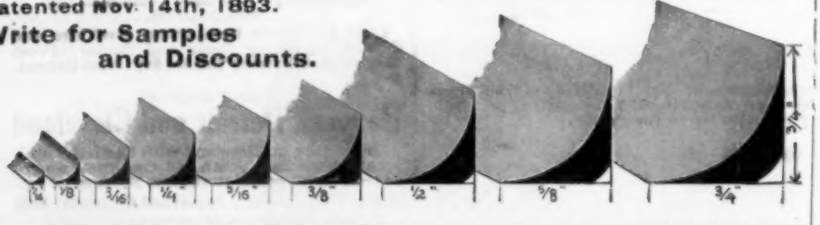

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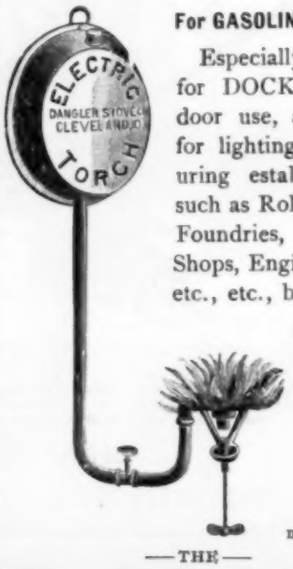

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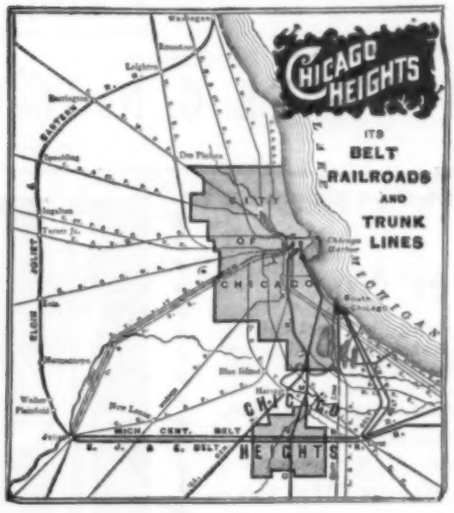

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FROM CLEVELAND TO	LEAVE	ARRIVE
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Depot foot of So. Water St. / City Office 137 Superior St.	Arrive.	Depart.
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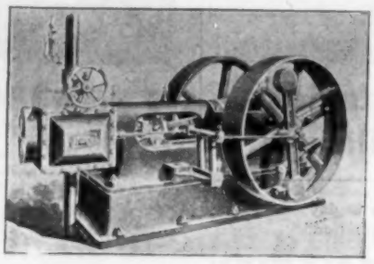

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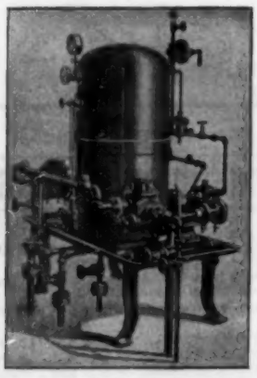

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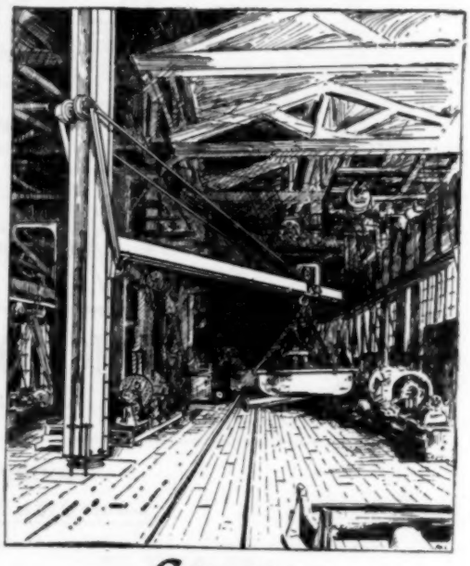

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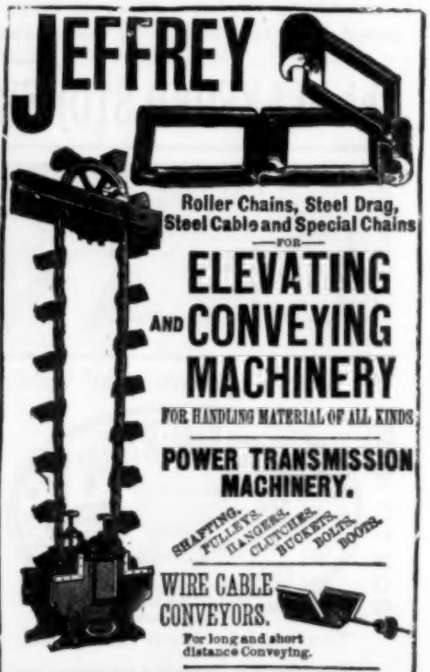

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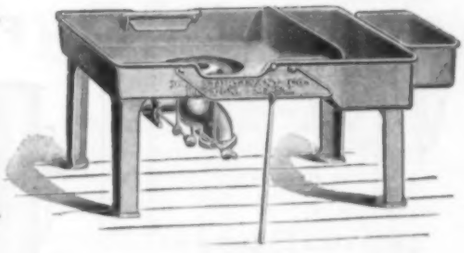

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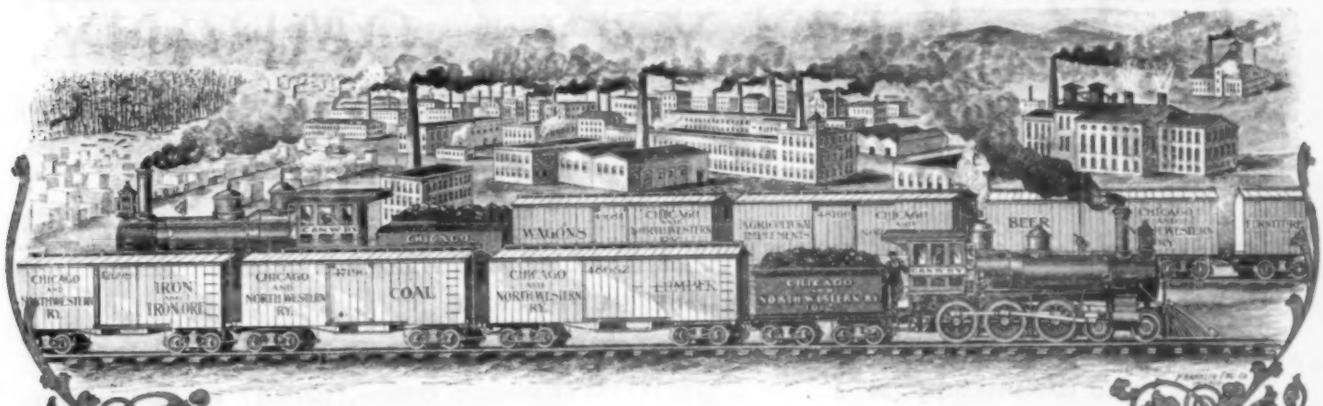

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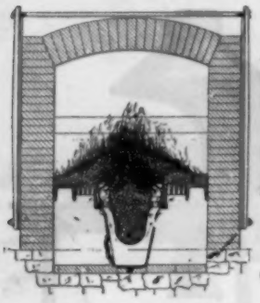

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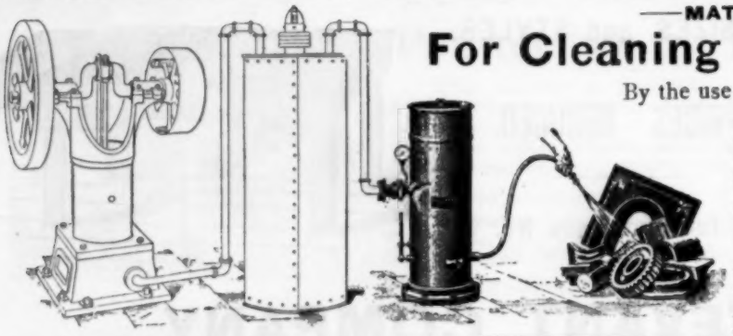

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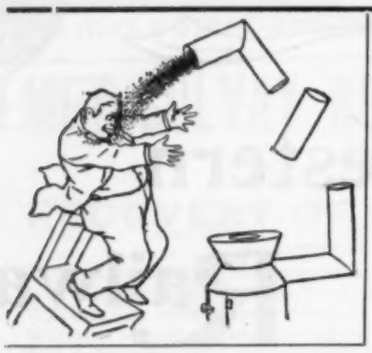

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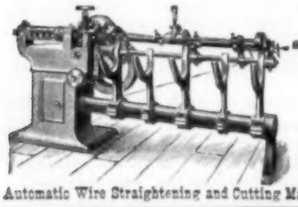

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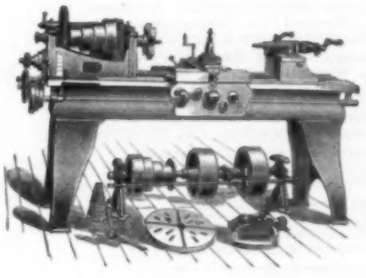

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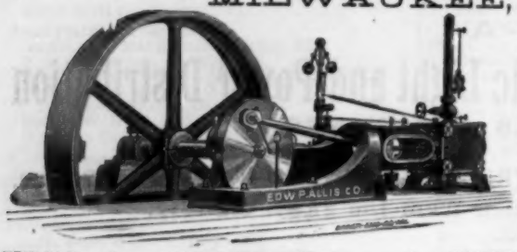

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Church, Isaac	39
Cincinnati Corrugating Co	2
Claflen Mfg. Co	39
Clearfield Fire Brick Co	39
Cleveland & Buffalo Transit Co	22
Cleveland City Forge & Iron Co	1
Cleveland Electrotype Co	25
*Cleveland Galvanizing Works	—
Cleveland Rolling Mill Co	39
Clinton Iron & Steel Co	21
*Clonbrock Steam Boiler Co	—
Coffman Coke Co., W. H	36
*C. M. & St. P. Ry	—
Cole, J. Wendell	40
Collins & Co., H. E	1
Dangler Stove & Mfg. Co	26
*Davis & Egar Machine Co	—
Deming Co	23
Detroit & Cleveland Steam Navigation Co	25
*Diamond Machine Co	31
Dickman & MacKenzie	2
Dixon, Jos. Crucible Co	35
Dover Fire Brick Co	39
East Chicago Foundry Co	18
Emmerton, F. A	2
Empire Boiler Cleaning Co	24
Enterprise Boiler Co	40
Finished Steel Co	21
*Fix Sons	—
Fleharty, J. H. & Co	25
Forster, Waterbury & Co	1
Fraser & Chalmers	21
*Freeman & Sons, S	—
*Fulton Steam Boiler Wks. & Fdy. Co	—
General Electric Co	25
Garden City Foundry Co	36
†Garden City Sand Co	19
Gerlach, Peter & Co	22
Gobeille Pattern Co	26
Goetze, Otto	2-18
*Greenfield, W. G. & G	—
*Haeseler & Co	—
Hamilton Foundry & Machine Co	1
Harrington & King Perforating Co	38
Harrington, Son & Co., Edwin	24
Harrison Safety Boiler Works	17
Hartford Steam Boiler Insp. & Ins. Co	33
Hazelton Boiler Co	22
Hooven, Owens & Rentschler Co	24
Hubbell, Harvey	40
Hunt & Co., Robert W	2
Illinois Central R. R	38
Illinois Screw Co	1
Indiana Bicycle Co	37
International Correspondence School	19
Iron Clad Paint Co	35
Jeffrey Mfg. Co	28
Jenkins Bros	36
Jessop & Sons, Ltd., Wm	31
Joues Foundry Co., W. A	1
Johnson Co., The	36
Junction Iron & Steel Co	2
Kellogg Weldless Tube Co	20
†Kelly & Co	30
Lambert Gas & Gasoline Engine Co	40
Lane & Bodley	22
Link Belt Machinery Co	23
Lloyd Booth Co	38
*Lodge & Shipley Machine Tool Co	—
Marine Iron Works	21
Marion Steam Shovel Co	39
McDowell Steel Co	39
McEwen Mfg. Co	28
McNaull & Co	23
Michigan Mining School	31
Miller Gas Engine Co	19
Mitchill, Cornelius S	27
Monarch Cycle Mfg. Co	26
Morton Tin Plate Co	22
Moyes, L. M	37
Moore Mfg. & Foundry Co	1
*Nanz & Co	24
Newell Bros	1
Newhall & Co	28
†Newport Sand Bank Co	31
Norman Co., J. J	26
North American Metaline Co	40
Oglebay, Norton & Co	22
Ohio Sand Co	40
Otto Gas Engine Co	35
Pittman, C. K	2
Pittsburg Steel & Iron Mfg. Co	26
Pollock, Wm. B. & Co	2
Playford Stoker Co	27
Pope, E. C	22
Prentiss Tool & Supply Co	31
Q. & C. Co	40
Rand Drill Co	2
Rippel Mfg. Co	1
Reese, Hammond & Co	40
Roberts Steel Chain Belting Co	36
Rockwell & Co., W. S	28
Salem Wire Nail Co	38
Semet-Solvay Co	28
‖Sharon Fire Brick Works	1
Sharpless & Winchell	40
Shiffler Bridge Co	37
Skinner Chuck Co	40
Southwark Foundry & Machine Co	22
Springfield Machine Tool Co	40
Standard Paint Co	39
Star Dynamo Co	35
Starrett Co	1
Sterling Emery Wheel Mfg. Co	38
Stirling Co	23
Stevens, F. B	30-40
Stilwell-Bierce & Smith-Vaile Co	2
Stowe, Fuller & Co	18
Stuart Fire Brick Co	37
Sturtevant Co., B. F	2-29
Sykes Iron Roofing Co	28
Taylor & Boggis Foundry Co	1
Textor, O	2
Tod, Wm. & Co	38
Toledo Machine & Tool Co	39
Totten & Hogg I. & S. F'dry Co	23
Trethewey & Co	26
Translucent Fabric Co	25
Union Mining Co	18
Universal Telephone Co	1
Upson Nut Co	1-21
Valley Iron Works	26
*Vulcan Iron Works, Toledo	—
Wickes Bros	2
†Ward & Nash	30
Westinghouse Electric & Mfg. Co	35
*Williams Mfg. Co	22
Westmoreland Fire Brick Co	35
Worthington, Henry R	23
Wright Co	31
Wellman Seaver Engineering Co	40
Young, J. D	21

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@ 4.75
No. 1 Bessemer hematite	4.00@ 4.25
Hematites No. 1 non-Bessemer	2.25@ 2.75
No 1. Specular, non-Bessemer	2.75@ 3.25

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$12 75@ 13 00
No. 1 Strong Foundry	12 50@ 13 00
No. 2 Strong Foundry	12 00@ 12 50
No. 1 Gray Forge, red short	11 00@ 11 25
No. 2 Gray Forge, neutral	10 75
No. 1 American Scotch	13 00
No. 2 American Scotch	12 50
Lake Superior Charcoal	13 50@ 14 00
PITTSBURG:	
No. 1 Foundry	$12 50@ 12 75
No. 2 Foundry	12 00@ 12 25
Gray Forge	10 75@ 11 00
White and Mottled	10 25
Warm Blast Charcoal	15 00@ 16 00
Cold Blast Charcoal	22 00
Bessemer	13 65@ 13 00
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	12 00@ 12 50
Local Coke Foundry No. 2	11 50@ 12 00
Local Coke Foundry No. 3	11 00@ 11 50
Local Scotch Foundry No. 1	12 00@ 12 50
Local Scotch Foundry No. 2	11 50@ 12 00
Local Scotch Foundry No. 3	11 00@ 11 50
Southern Coke No. 1	12 10@ 12 35
Southern Coke No. 2	11 60@ 11 85
Southern Coke No. 3	11 10@ 11 60
Southern No. 1 Soft	11 60@ 11 85
Southern No. 2 Soft	11 35@ 11 50
Southern Silveries No. 1	11 85@ 12 35
Southern Silveries No. 2	11 60@ 11 85
Jackson Co. Silveries	14 50@ 16 00
Ohio Silveries No. 1	15 00@ 15 50
Ohio Silveries No. 2	14 50@ 15 00
Ohio Strong Softeners	15 00@ 15 50
Alabama Car Wheel	16 85@ 17 35
Malleable Bessemer	13 00@ 13 50
Coke Bessemer	13 00@ 13 50
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$ $11 00
Southern Coke No. 2 and No. 1 Soft	10 50
Hanging Rock Coke, No 1	12 50@ 13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	13 00@ 14 00
Jackson County Silvery No 1	14 00@ 14 50
Southern Coke, Gray Forge	9 50
" " Mottled	9 50
Standard Alabama Car Wheel	15 00@ 16 00
Tennessee " "	14 00@ 15 00
Lake Superior " "	15 25@ 15 50
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$13 00@13 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	12 50@ 12 75
Ohio Strong Softener No. 1	13 00@ 13 50
Jackson Co. Silvery No. 1	15 25@ 15 50
Lake Superior Charcoal	13 50@ 14 00
Southern Soft No. 1	12 15
Hanging Rock Charcoal	17 00
ST. LOUIS (reported by Rogers, Brown & Mercham):	
Southern Coke No 1	$ $11 50
Southern Coke No. 2	11 00
Southern Coke No. 3	10 50
Southern Gray Forge	10 00
Southern Charcoal No. 1	15 00
Missouri Charcoal No. 1	14 00@ 15 00
Ohio Softeners	16 00
Lake Superior Car Wheel	15 00
Southern Car Wheel	16 25

OLD RAILS AND SCRAP METAL.

	GROSS TONS
Old iron rails	$16 50
Old steel rails	12 50
Old car wheels	13 00
	NET TONS
No. 1 R. R. wrought scrap	$12 75
Mill scrap	10 00
No. 1 Machine cast scrap	10 00
Iron axles	17 50
Axle turnings	9 00
Wrought turnings (free from cast)	8 00
Cast borings	7 00
Uncut wrought iron boilers	4 00
Steel boiler plates	10 00
Grate bars	6 75
Pipes and flues (clean)	10 00
Tank iron	10 00
Hoop and band iron	7 00
Sheet iron	6 50
Wrought drillings	7 50
Malleable iron	10 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.64c
Angles	1.34c@1.39c
Tees	1.49c
Universal Plates	1.40c
Sheared Plates	1.45c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ½ to 1 inch	1 30
4½ to 6 by ½ to 1 inch	1 35
1½ to 6 by 1¼ to 2 inch	1 35
1¼ & 1½ by ¼ to ½ inch	1 20
1 & 1¼ by ¼ to ½ inch	1 20
⅛, ¾, ⅞, by ¼ to ½ inch	1 20

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.
THE CADY MFG. CO.
18, 20 and 22 Johnson St., CLEVELAND, O.

SEND FOR OUR NEW CATALOGUE OF Power Presses, Drop Hammers, Punches and Shears, Wire Working and Special Machinery.

PERFORATED METALS

OF ALL KINDS FOR
MILLING MINING AND
AGRICULTURAL MACHINERY,

PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.

THE ROBERT AITCHISON. PERFORATED METAL CO.,

OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

A. H. LEITCH, PREST. JOHN C. LEITCH, SEC. AND TREAS

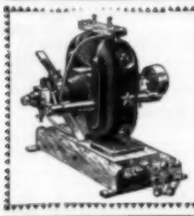
WESTMORELAND FIRE BRICK CO. MANUFACTURERS OF HIGH GRADE FIRE BRICKS.
PITTSBURG, PA.
Works and Mines, Westmoreland, Pa.

DIXON'S GRAPHITE PAINT

FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL. Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.



SMALL DYNAMOS

For Incandescent Lighting,

In Factories, Mills, etc., at a Reasonable Price.

If you have power put in your own lighting plant. Write for our Catalogue.

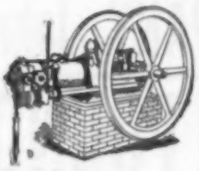
STAR DYNAMO CO., Jefferson City, Mo.

POWER From **GAS OR GASOLINE.**

No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 250 horse-power. } **Can be Used in City or Country.**

THE OTTO GAS ENGINE WORKS, Inc.
33d and Walnut Sts., PHILADELPHIA, PA.
S. M. York, 42 S. Water St., Cleveland Agent. Over 45,000 Sold.



IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅞ inch	1 10
2 to 2⅜ inch	1 30
2⅜ to 3⅛ inch	1 25
3⅜ to 4 inch	1 60
4¼ to 4⅝ inch	2 20
4⅝ to 5 inch	2 40

Oval.

⅜ to 1¼ inch	1 30
⅝ to ¾ inch	1 30
½	1 50
⅜	1 70

Half Oval and Half Round.

1⅜ to 3 inch	1 65
⅜ to 1⅛ inch	1 45
½ to ¾ inch	1 70
⅝	1 85
⅜	2 90

Heavy Band.

1¾ to 6 by ¼ and 5-16 inch	1 20
1 to 1¾ by ¼ and 5-16 inch	1 25
¾ to ⅞ by ¼ and 5-16 inch	1 35
⅛ to ¾ by ¼ and 5-16 inch	1 60

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 35
1 7-16 to 2, No. 17, 18 and 19	1 40
1 7-16 to 2, No. 20	1 50
1 7-16 to 2, No. 21	1 60
1 7-16 to 2, No. 22	1 70
1⅛ to 1⅜, No. 13, 14 and 15	1 40
1⅛ to 1⅜, No. 16, 17 and 18	1 45
1⅛ to 1⅜, No 19 and 20	1 50
1⅛ to 1⅜, No. 21	1 60
1⅛ to 1⅜, No. 22	1 70
15-16 and 1 inch, No. 13, 14 and 15	1 35
15-16 and 1 inch, No. 16, 17 and 18	1 50
15-16 and 1 inch, No. 19 and 20	1 60
15-16 and 1 inch, No. 21	1 70
15-16 and 1 inch, No. 22	1 80
⅞, No. 13, 14 and 15	1 60
⅞, No. 16, 17 and 18	1 70
⅞, No. 19 and 20	1 80
⅞, No. 21	1 90
⅞, No. 22	2 00
13-16, No. 13, 14 and 15	1 70
13-16, No. 16, 17 and 18	1 80
13-16, No. 19 and 20	1 90
13-16, No. 21	2 00
13-16, No. 22	2 10
¾, No. 13, 14 and 15	1 80
¾, No. 16, 17 and 18	1 95
¾, No. 19 and 20	2 05
¾, No. 21	2 15
¾, No. 22	2 25
11-16, No. 13, 14 and 15	2 05
11-16, No. 16, 17 and 18	2 10
11-16, No. 19 and 20	2 20
11-16, No. 21	2 30
11-16, No. 22	2 40
11-16, No. 23	2 50
⅝, No. 13, and 15	2 10
⅝, No. 16, 17 and 18	2 20
⅝, No. 19 and 20	2 30
⅝, No. 21	2 40
⅝, No. 22	2 50
⅝, No. 23	2 60
9-16, No. 13, 14 and 15	2 30
9-16, No. 16, 17 and 18	2 40
9-16, No. and 20	2 50
9-16, No. and	2 60
9-16, No. 221	2 70
9-16, No. 22	2 80
7-16 ad ½ inch, No. 13, 14 and 15	2 50
7-16 and ½ inch, No. 16, 17 and 18	2 60
7-16 and ½ inch, No. 19 and 20	2 70
7-16 and ½ inch, No. 21	2 80
7-16 and ½ inch, No. 22	2 90
7-16 and ½ inch, No. 23	3 00
⅜, No. 13, 14 and 15	3 00
⅜, No. 16, 17 and 18	3 00
⅜, No. 19 and 20	3 10
⅜, No. 21	3 20
⅜, No. 22	4 50
⅜, No. 23	3 60

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 60
1½ to 6 by Nos. 11 and 12	1 65
1 to 1¾ by ⅛ to 3-16 inch	1 65
1 to 1¾ by Nos. 11 and 12	1
⅝ and 13-16 by ⅛ to 3-16 inch	1
⅝ and 13-16 by Nos. 11 and 12	1 75
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ⅛ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	1 50
⅛ inch, " " " " 13 and 14	1 60
¼ inch, " " " " 11 and 12	1 65
¼ inch, " " " " 13 and 14	1 75

Sheet Iron.

No. 10	1 45
No. 12	1 55
No. 14	1 65
No. 15-17	1 75
No. 18	1 90
No. 20	2 05
No. 22-24	2 15
No. 25-26	2 25
No. 27	2 35

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 45
Shell	1 60
Flange	1 70
Marine Flange	2 00
Fire Box	2 50

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1⅛c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	08
9-16 to ⅞ in. "	08

Soft Steel Bars, Light

LOW PRICES

do not always influence business. Some brands of goods are undesirable as a **Gift.**

Write us for our catalogue and send us a sample order and see if there is not **Economy** in using **First Quality** goods at Fair Prices.

Structural Shapes, Rails.

TIN PLATES,
CALVANIZED SHEETS,
CORRUGATED IRON,
BLACK PLATES,

Sheet Iron and Steel, any finish, patent leveled or common.

Aetna Standard Iron & Steel Co.,
BRIDGEPORT, OHIO.

ROBERTS STEEL CHAIN BELTING CO., Pittsburg, Pa.

Elevating and Conveying Machinery

For Handling all kinds of materials.

Special Wrought and Steel Chains of every description; Coil and Cable Chains; Chain Haulages for Coal Mines; Sprocket Wheels; Complete Coal and Ashes Handling Plants; Wire Rope Haulages and Wire Rope.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

STEEL CASTINGS

FROM 10 LBS. UPWARD.

Made from Best Open-Hearth Steel.

ALSO SAND ROLLS AND CAST-IRON PINIONS.

SEND FOR ESTIMATES.

THE JOHNSON COMPANY, Johnstown, Pa.

GARDEN CITY FOUNDRY CO.

INCORPORATED.

Successors to TURNER, DICKINSON & CO.

Armitage and Central Avenues, Station G, Chicago, Ill.

FRICTION CLUTCHES, HANGERS, PILLOW BLOCKS & PULLEYS.

Large Stocks on Hand. Shipments Promptly Made.

We Claim The Following Merits for Jenkins Bros.' Valves

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Cont-in JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark,

JENKINS BROTHERS, NEW YORK, PHILADELPHIA, CHICAGO, BOSTON.

7-16 to ⅝ and 2¾ to 3 in.	.09
3½ to 4 in.	.09½
⅝ to 11-16 and 4¼	.10
¾ to 6 in.	.10½
¼ to 9-32 and 6¼ to 7 in.	.11
7½ in.	.13

Flats.

	cts. lbs
2 to 9-16 in. wide by 2 to ⅝ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price, 1 50
Open-hearth Tire	" 1 80
Open-hearth Spring	" 2 20
Sleigh Shoe	" 1 90
Toe Calk	" 2 10
Cutter Shoes, tapered and bent	" 2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " " "	dis.
Lap " galv. "	dis. 52½
Butt " " "	dis. 50
Boiler tubes 2¼" and smaller	dis. 62½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1¼"	dis 50&10
Morse Taper and Straight Shank Larger than 1¼"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING-MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

Main Office and Works:
48th Street and A. V. Ry.
PITTSBURG, PA.

Branch Offices:
1123 Betz Building, Philadelphia, Pa.
65 Dexter Building, Chicago, Ill.
228 Lumber Exchange, Minneapolis, Minn.

CAMBRIA STEEL.

Steel Rails, Blooms, Billets, Bars, Axles, Angles, Channels, Forgings, Locomotive Car and Structural Steel.

CAMBRIA IRON COMPANY, S. W. Cor. 15th and Market Sts., opp. Penna. R. R. Station, Philadelphia; Chicago office, Western Union Building; New York office, (for Rails and Axles), 33 Wall St.; Cleveland office, Bourne, Fuller & Co. Works at Johnstown, Pa.

GAUTIER STEEL DEPARTMENT OF CAMBRIA IRON CO.,

JOHNSTOWN, PA.

MERCHANT BAR STEEL: Including Tire, Toe Calk, Machinery, Carriage Spring, Railroad Spring, Hoe, Rake, Fork, etc.
AGRICULTURAL STEEL AND SHAPES: Finger Bars, Knife Backs, Rake Teeth, Bundle Carrier Teeth, Tedder Forks and Springs, Spring Harrow Teeth, Harrow (Drag) Teeth, Seat Springs, etc.
PLOW STEEL: Flat and Finished Plow Shapes, Digger Blades, Slabs (Penn and Perrot), Hammered Lay, Rolled Lay, etc.

Cold Rolled Steel Shafting. **Steel Harrow Discs.** **Cambria Link Barb Wire.**

New York Office,	Philadelphia Office,	Chicago Office,	Atlanta Office,
102 Chambers St.	611 Phila. Bourse,	209 Western Union Bldg.	325 Decatur st.

STUART FIRE BRICK CO.
MANUFACTURERS OF
Silica Brick
For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.
Office, Room 21, Conestoga Bldg., Cor. Wood and Water Sts., PITTSBURG, PA.

COMBINE SAFETY WATER TUBE BOILER
L. M. MOYES, MANUFACTURER, PHILADELPHIA, PA.

Waverley BICYCLES.

AMERICA'S FAVORITES,

Are built in the largest and best equipped factory in the World,

Experienced dealers recognize the importance of handling a standard line of wheels, something that has an established reputation and that everybody knows. It is uphill work trying to sell unknown wheels. It is no work at all to sell the Waverleys. Only dealers who handle them know how easily they are sold. You can make more money with less labor selling Waverleys than any other bicycle,

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Stub's ..... dis 25
Grobet's ..... dis 30
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Atha new list, Jan. 15, 1887 ..... dis 50
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Illinois Bolt Co. list ..... dis 75

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List July 14, 1887 ..... dis 85
Standard Penny Nails, ℔ keg card rate
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Brass and Copper ..... dis 50
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Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
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Cards, Hand and Nut to 2 in. ..... list
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in. ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

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Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

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Copper ..... dis 40
Bright and annealed, Nos. 0@18 ..... dis 70&10@75
" " Nos. 19@26 ..... dis 75@75&5
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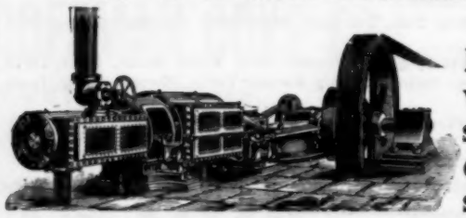

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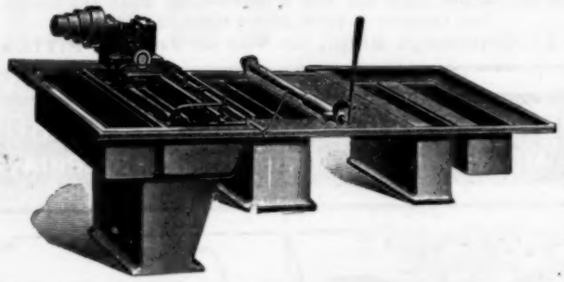

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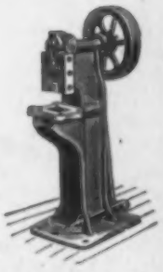

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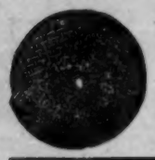

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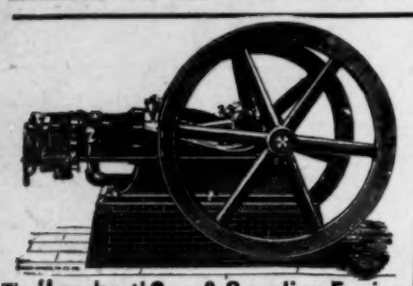

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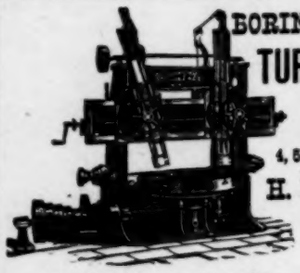

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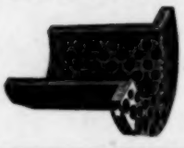

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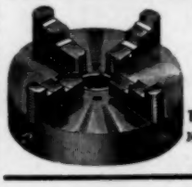

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